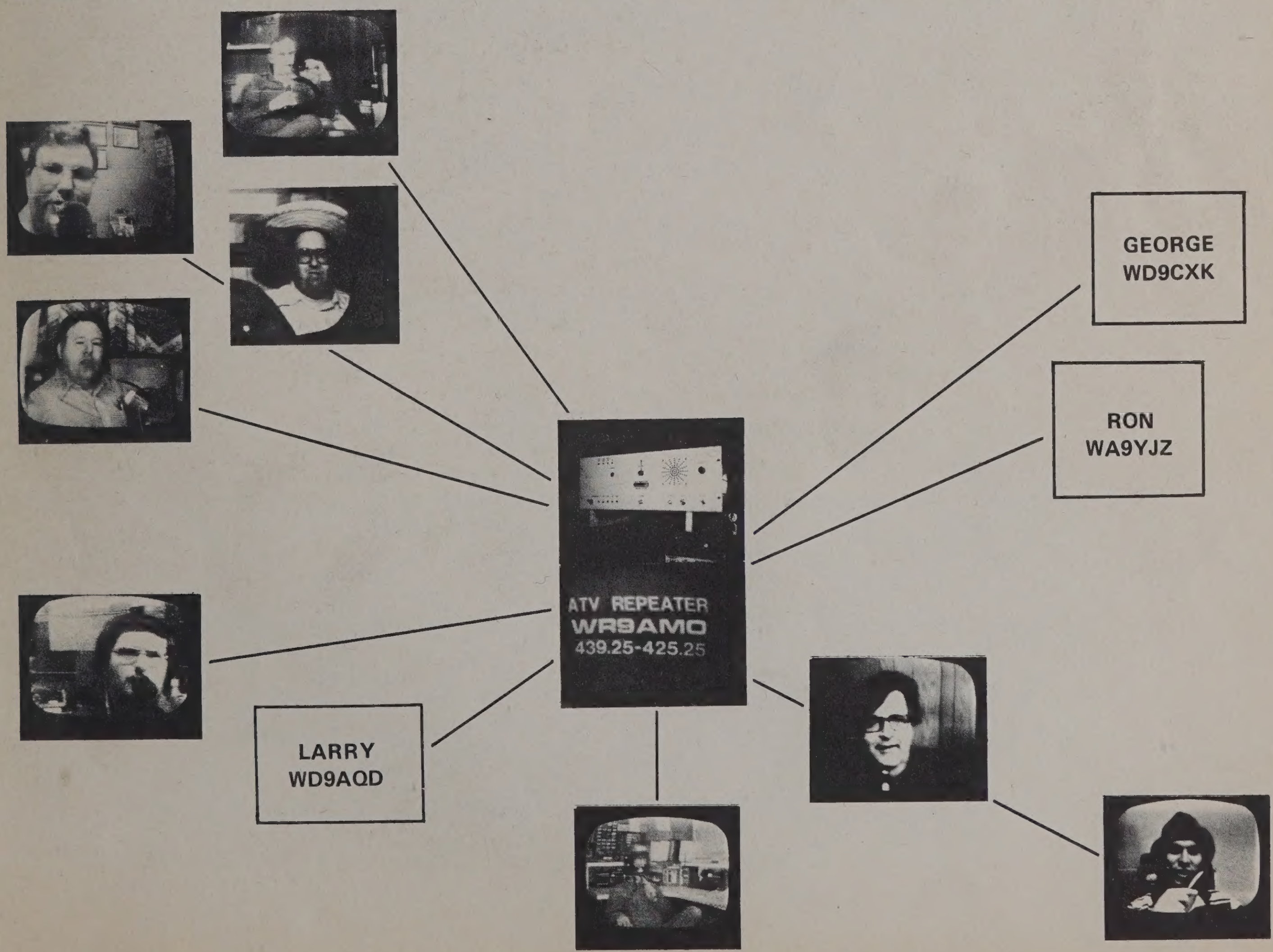
Our 12th Year $1.25

AMATEUR TELEVISION MAGAZINE

MAY-JUNE, 1979 Vol. 9, No. 3

PLUS NEWS & LOTS OF OTHER GOODIES



DEVOTED TO HAM TV

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NEWS

TOUCH UPS

Last issue A5 had a great article by Takao Yabana JAØBZC for a new type of scan converter which uses the new BBD devices, and indicated that Takao was willing to send others the devices for cost plus shipping. Well, somewhere along the line your scribe forgot to put in Takao's address, so here'tis: 4-29 Habaue, Matsumoto, Nagano, Japan 390.

In the article for the 450 Mhz conduction cooled amp, the diagram for the input circuit got left out. It consists of a small open air variable capacitor in series with a 1.75" long piece of brass sheet which is 3/16" wide. The input coupling loop is made from the same brass sheet, and connects from the BNC input connector directly to the closest ground point of the tube socket. There should be about 3/16 inch between the parallel brass strips.

The tube socket can be either an Erie or Eimac. Both have the built in screen by=pass caps, noted as "SKT" in the diagram.

The cover photo last issue was Charles Ruh, at age 6 mo. Now 15 months, he loves to play with all the goodies in his dad's hamshack, which is not discouraged at all.

DAYTON 79 WAS FANTASTIC

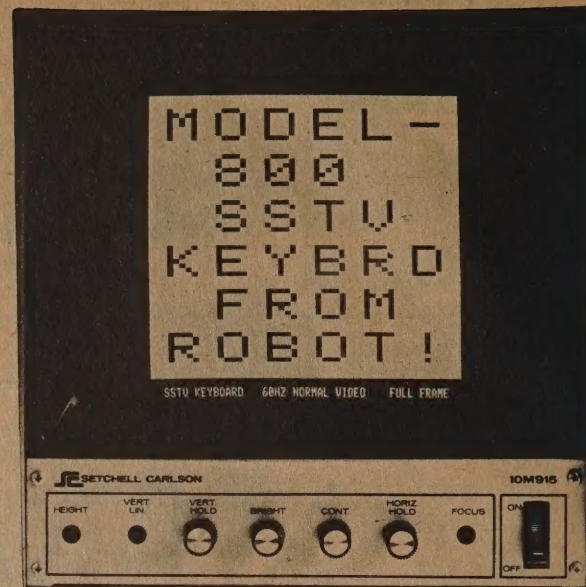
The amount of ATV activity was about twice that of previous events, with more than double the forum time than before which gave everyone an opportunity to talk on all aspects of ATV. Included were talks on slow scan, medium scan, fast scan, recomendations for commercial products to get started right for those who do not have the time, space or facilities to built it yourself, plus an excellent demo and talk on FM video and gunnplexer ATV.

The suprise of the show had to be ROBOT's new SSTV KEYBOARD, which is mircoprocessor based and is programmed for a zillion fun functions. Robot was quick to point out that what they had on display were the first prototypes and actual delivery would be in about 90 days for production models. Since it is based upon software (computer program in the microprocessor) rather than hardware based (descrete functions hard wired to IC's) any future changes can be simply made by re-programming the unit rather than re-wiring or modifying the physical unit. The Robot engineer in the booth indicated that it would be equally at home in FSTV as well as SSTV since it had a real video output as well as the audio output for the rig. The fast scan output also provided direct on screen display of operating mode, including keyboard/gray scale/ checkerboard, 525/625 scan standards (50-60 HZ) full, half or other display sizes. The frame size can be called from the keyboard and is controlled line by line, so any amount from 1 to 6 lines (6 characters to a line) can be used at any time. There is also a normal reverse switch (positive or negative) 36/18 character selection, 6 bar gray scale and an 8 x 8 checkerboard test pattern.

In addition to the normal alpha-numerics type keyboard, there is a 12 button function section for cursor control including HOME, clear screen, and other control functions. The cursor also blinks visably on the video monitor so you always know where you are on the page. A cursor line follows the SSTV output (as displayed on the FSTV monitor) to indicate exactly where the output signal is in relation to the data on the page. GREAT! In the large character mode, there are three lines of six characters each, and 6 x 6 in the small font size.

While the price of the Robot model 800 SSTV keyboard was not announced at Dayton it has been learned by A5 that it will be priced substantially less than other units presently available.

This photograph of the TV display from the ROBOT Model 800 SSTV Keyboard illustrates one of the many operating modes available. In this illustration the Model 800 Keyboard is transmitting an SSTV picture in the 36 character mode, black characters on white background, 6-character-line transmission, at SSTV's 60 Hz standard rate (15 lines per second).



ROBOT MODEL 800 SLOW SCAN TV KEYBOARD

For Composing and Sending Alphanumeric Messages Via SSTV; Featuring Simultaneous Fast Scan TV Display.

The announcement of Robot's new product also comes on the tenth anniversary of Robot. Starting back with the original model 70 SSTV monitor and model 80 SSTV camera then with the model 300 analog scan converter, then the model 400 digital scan converter (with the model 500 commercial scan converter). Ten years of quality products, continous operation and development of new products. For information on the new SSTV/FSTV keyboard, write to Robot at 7391 W. Convoy Court, San Diego, CA 92111.

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Two-meter beams deliver maximum gain and clean patterns, with VSWR of less than 1.2:1 across the entire 144-148 MHz range. High grade insulating materials, weather-resistant aluminum boom and elements. 12, 14 and 16-element beams make outstanding moon-bounce building blocks.

14-Element KLM-144-148-14 **$65.95**

Gain: 14.2 dBd. Beam width at 3 dM pt.: 18 degrees. Feed impedance: 50 ohms balanced (KLM 1:1 Balun, 144-148-50 optional). Boom dia.: 1½". Boom length: 17.33'. Max. mast size: 1½". Center mounting. Wt.: 8 lbs.

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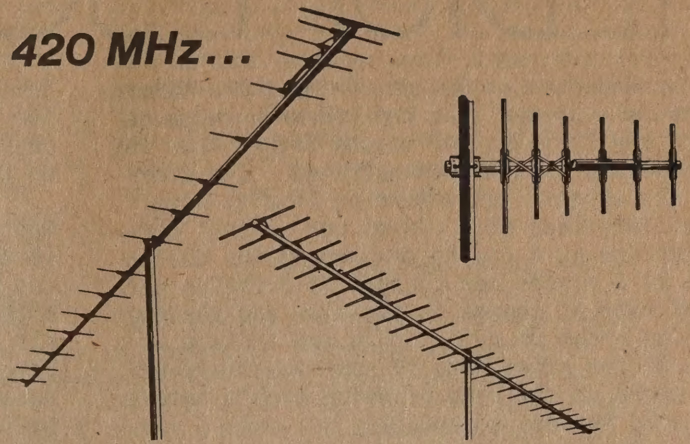
420 MHz...



A versatile series of KLM beam antennas in a variety of configurations: broadband rear-mount type for horizontal or vertical arrangement, ultra-high-gain DX type, and optimized long boom Yagi for narrow-band use. All have VSWR less than 1.2:1 across the entire band. Maximum mast size: 1½".

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14-Element KLM-420-470-14 **$31.95**

End mountable; vertical or horizontal polarization. Excellent for repeater control. Frequency: 420-470 MHz. Gain: 13.7 dBi. Beam width at 3 dB pt.: 24°. F/B ratio: 20 dB min. Feed impedance: 50 ohm balanced. Boom dia.: 1". Boom length: 4.75'. Wt.: 4 lbs.

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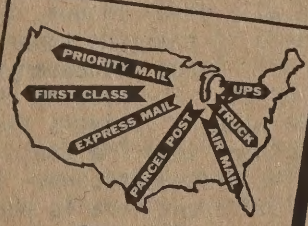
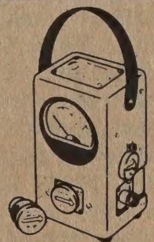


CENTRAL LOCATION FOR FAST SHIPMENT



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MEDIUM SCAN TV

Tests conducted at Dayton, Ohio at the Hamvention definitely showed that the viewer acceptance preferred the 2 fields per second rather than any of the interlace systems demonstrated. The other three 16 Khz systems that were on display were: horizontal interlace at 4 fields per second, vertical interlace at 4 fields per second and double interlace at 8 fields per second. At 8 fields per second the rate of change is too slow and the eye looks at the break up rather than the picture as a whole. On the other hand if some way could be found to speed up the rate of doing double interlace it would be very acceptable.

Higher bandwidth systems were also demonstrated and everyone liked the 8 fields per second frame grab system. This of course, is a 64 Khz system and no easy wan can be envisioned to use this rate of transmission. It was therefore concluded for the remainder of the STA (July 1980) that we would go for 2 fields per second. A Robot 400 with an extra memory obtainable from W9NTP and an external small buffer memory can make it possible for everyone to transmit jerky motion and to also receive it. More will be described about the details later.

After the STA is concluded, a report will be written and submitted to the FCC along with our recomendations for future systems. It is hoped that at that time we can request an extension of the STA to test more elaborate systems. This is why each of you should let it be known that you are interested in getting your technical feet wet. Let us talk about micro-processor systems. Some of the simpler versions can be built up directly from hardware so you need not own a particular micro-processor system to become involved.

When we field grab a TV picture in 1/60 of a second, we hold it in memory until the next time for the second transmission. This time period will depe depend on how fast we can get rid of the data in the allocation of bandwidth. For instance, a SSTV image has 128 pixels, 128 lines and 4 bits per pixel. This gives a total number of 65,536 nits in each stored image. Some time later we store another field and it also has 65,536 bits. We now have two pictures in a memory that have been placed there at different times. Once we have transmitted the first 65,536 bits is there any need of transmitting all 65,536 bits of the second picture? Of course the answer is no. We need to only transmit those bits that are different. We have been talking as if the transmission is going to be in a digital format but the principle also holds true if we make an analog transmission.

What has just been written is old stuff to picture processors. At once they will point out that this is great but since you do not know where the changes are, it will be necessary to not only send bits of information but also the address of these bits too. In other words the overhead makes it an inefficient system. What can be done? Think up an algorithm that minimizes the overhead.

Books have been written and Bell Telephone has spent a fortune for the ideal system. Let us take an amateur viewpoint and see how it can be done for a picture quality image comparable to SSTV. Take the SSTV format of 128 pixels and 128 lines into groups of 8 also. The resulting checkerboard now consists of 256 squares. Each of these aquares can be ref red to in binary code of 8 bits. Each sma;; square consists of 64 pixels. The total number of bits of information that needs to be transmitted for a given square is 72 bits. This makes it 89% efficient. In this case it is assumed that the video data will be transmitted in analog format. If it were possible to transmit it digitally (not now legal) it would be even more efficient. The square consists of 256 bits. The total number of bits would be 264. The efficiency is therefore: 97%.

Before you get too excited let us consider the problems involved in doing this complicated signal sorting. It is very easy to store a field of digital picture and compare it to a previously stored field. The comparison can be made with an "exclusive OR" circuit. Each of the little squares can be compared and a counter used to count the pixel differences or the bit differences in side a given pixel. Assuming that we will compare only pixels and only the top three bits at that will give an indication of changes. Once these changes have been counted the next square can be checked for change. This will take 256 computations. The next step will be to put in order the squares that have the most change. It is very probable that only a few of the squares will have enough changes to make it necessary to transmit ehm. The time of transmitting a square can be easily calculated: 8 x 8 pixels times subfield rate equals 16 Khz. The field rate is therefore 512 squares per second. It is easilly noted that if the camera is panned that all 256 squares will be changed and the time required for transmission is ,5 seconds (2 fields/sec). This of course is to be expected.

In order to try out different algorithms and other techniques, I would like to suggest interim simpler systems before we launch into a full 256 calculation. Consider the screen divided up into three vertical strips. Each strip will consist of 40 pixels and 128 lines. Two images are stored in two memories as before but only three calculations and ordering must be

medium scan continued.....
must be done in this system. In fact, the problem can be easily built up with "exclusive OR" or comparator hardware and eliminate the need for microprocessors and software. Once practice is accumulated with a three area system, divide the vertical lines into three groups and now we have 9 squares. The problem now begins to approximate the 256 squares. It may be that 9 squares works out to be a very useable system. In review, each of the 9 squares must be checked against its equal in the other stored memory. Once the total number of pixel changes in each of the 9 squares has been made the ones with bhe most number of changes must be placed at the top of the priority list for transmission. At this time it is not known wether or not the speed of transmission will give adaquate motion. Let us all experiment and find out.

All that has been said has been directed toward analog transmission. If it is contimplated to go to digital transmission which is desirable, the bandwidth will increase four times. When this format is chosen it is hoped that the 256 square system and addition of only transmitting the bits that change within the pixel will allow the motion without excessive bandwidth. 73 Don W9NTP Box 95 Waldron, IN 46182

SSTV IDEAS

For those of us without SSTV keyboards, the ability to add graphics to our SSTV pix is somewhat limited. HOWEVER here is an inexpensive was which does not have the drawbacks of using "menu boards" to title or do graphics for SSTV. It will work equally as well for FSTV too!

Most business supply stores have available a white porcilin board and aluminum tripod. These have an aluminum tray at the bottom for your crayons or markers. Mine is two feet high and three feet wide. I write on mine using "magic " markers and erase the drawings with a common chalk eraser. The advantage is, the drawings are black on white, just like printed pages, and the system erases cleanly and does not leave an after image as regular "black" boards and chalk do. A damp cloth removes any residue and the board is ready to go again. Its light and can be used for used for meetings and presentations as well (great for ATV talks at hamfests).

If you polish the board surface with a high quality silicon glaze type polish, the type which goes on wet, you let dry, then buff up, you can go for weeks before the ink markers begin to stick, then you simply clean and poli polish the board again. In the meanwhile, simply wipe the board with the eraser and draw anew. For SSTV contacts this allows for some quick art work, graphics or "CQ DE " and other messages to be written quickly for the camera to pick up. You can leave any part of the previous message and just change calls, signal reports etc, which makes it great for contests and nets. Because there is no limit to the graphics you can be as artistic as you like.

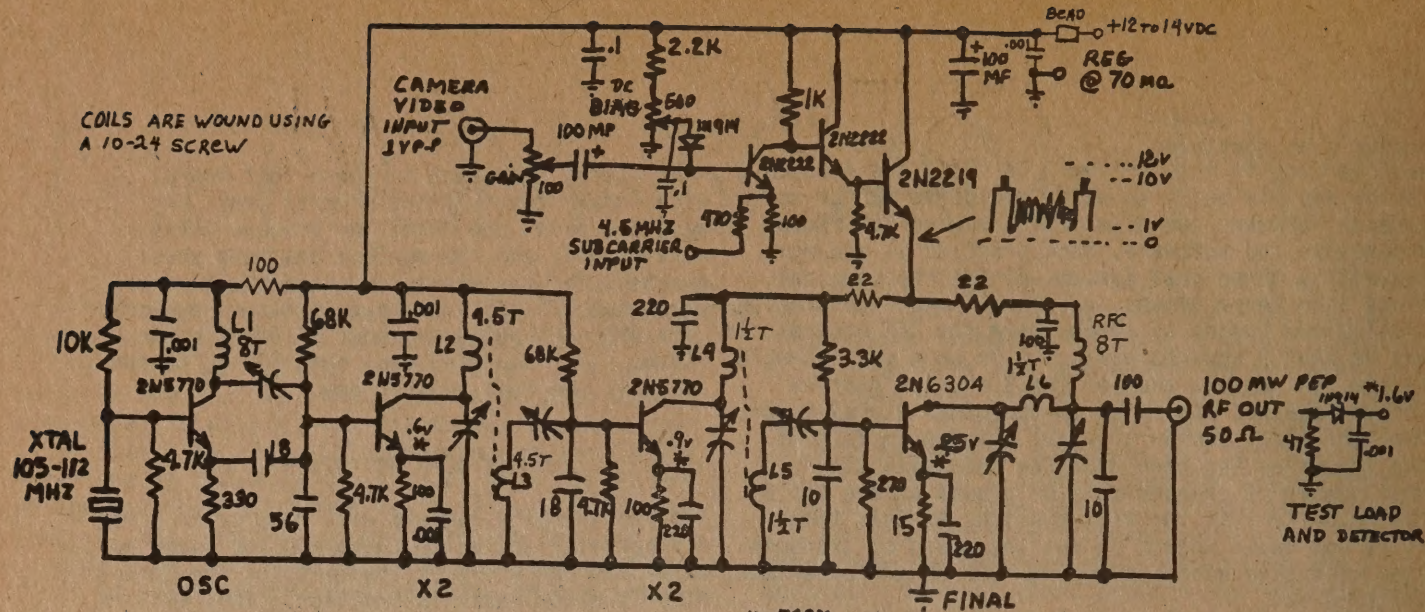
Normally the boards and tripods (which have telescoping legs) sell for about $60, plus the markers and eraser. Your scribe has found a source for these which include the following items: Two foot by three foot board, with "chalk tray" three marking pens, one red, one blue, one black, an eraser, colapable tripod, and the surface has been pretreated for the great low price of $40, or more than 1/3 off. Delivery is two-three weeks via UPS. Shipping is about $6 for the two boxes. If you want one, send $45 to A5 and we will see that you get one.

OTHER NEWS AND STUFF

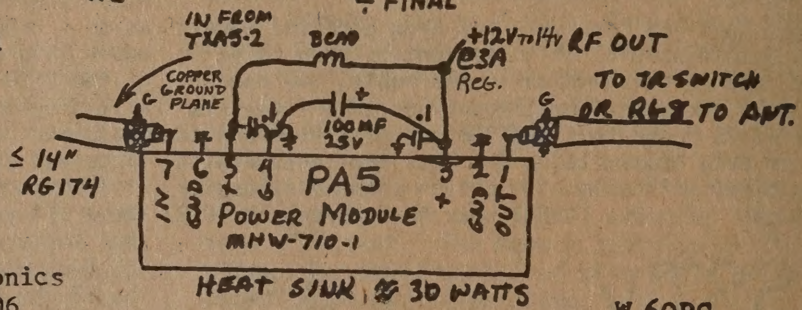
The Indianapolis Hamfest will have quite a bit of ATV activity including the new color radar beacon on 425.25 Mhz which is transmitting the Channel 8 WISH-TV color radar information. They will be using a W6ORG (PC Electronics) exciter and MHW-710 power chip with an antenna at the 150 foot level of the WISH TV tower. In addition, the hamfest will will provide the first in a long time antenna measuring contest for two meter antennas. Any licensed ham may participate. Frequency aprox 147 Mhz, polarization, vertical. Reference will be a 1/4 y groundplane. There is no size limit but the array must be able to be mounted to a 15 foot high 1.25" mast. Transmission line will be 52 ohm terminated in a UHF type connector, you may use your own adaptor. Prizes for most gain and least gain. Also most gain/element.

They will also have an ERP contest for portable portable equipment! This is also for two meter gear, vertical polarization. The transmitter must have an internal power source, contestant must be able to carry the equipment at least 100 yards, no mobiles. The distance from the transmitter to the measurement equipment will be fixed and uniform. measurements will be made while the equipment is in the portable mode. Now there is a real channenge. Let see, two KLM 16 element beams, car battery, KW solid state amp, back pack, ...

Glen Baumgartner has some surplus T-282 transmitters for sale. (913-651-6612). These tune from about 180 to 420 Mhz and if you remove the mechanical stop on the chain drive, keep on tuning to 470 Mhz! Stock they were made as AM xtal controlled transmitters. Seperate 60 Hz power supply and TX unit. You can either plug in your own 12 Mhz rock and tune up, or simply use the 4x150's in the final as an amp for your present exciter. Right out of the box I was able to get an easy 200 watts using a 10 watt peak/sync (3.5 watts average) video exciter. Bandwidth is great also. A few very simple changes (rip out the AM modulator and siscard) allow higher power up to 1 KW DC input. CHEAP CHEAP Price ready to go is about $75 for the TX $30 for the power supply, packed to ship via truck. Get them while they last!



* USE VOLTMETER ON EMITTER FOR PEAKING TRIMMERS. VOLTAGES ARE MINIMUMS



Schematic for the Exciter/ modulator of Jan issues ATV transceiver project. Completed units are available from PC electronics 2522 S. Paxson Ln. Arcadia, CA 91006 $69 post paid. (exciter)

W 6ORG
9-77
C

CQ SSTV DE K4TWJ

DAVE INGRAM

Contributing Editor
Amateur Television Magazine

Eastwood Village No. 1201 South
Rt. 11 Box 499
Birmingham, AL 35210

WOW!

The many happenings in our world of video communications are practically mind boggling to review. As I begin assembling the SSTV column for this issue of A5, I truly feel we are in the prime of our expansion-and our future will be a dazzling array of concepts affecting all amateurs and many non-amateurs.

The people of Pitcairn Island should now have a visual link with the outside world, and this Robot 400 System may prove an invaluable asset for their future health, education and welfare. We'll all be wishing Tom Christian, VR6TC, total success in his forthcoming SSTV activities. I'm sure everyone shares my grave concern for the Pitcairners. They're experiencing problems surviving, and they're feeling the pressure of our world inflation. Hopefully, the visual link of SSTV will provide assistance-by-proxy for the areas in which our knowledge can favorably affect their livelihood.

Dr. Don Miller's, W9NTP, Medium Scan TV presentations at the Dayton Convention were a rollicking success. Assuming this mode continues to progress during future months, we will have a capability which can ultimately affect millions of lives throughout the world. I'm still "fired up" over the Medium Scan TV repeater concept, and I also consider this as an effective means of introducing thousands of non-hams to Amateur Radio. Let's assume a group of SSTVers in a large city place a 10 meter Medium Scan to 70 cm Fast Scan repeater on the air. The incoming audio is conveyed by a 2 meter link. The users of this system frequently visit the "repeater and scan converter site" (merely the best DX-located users home QTH) to renew their prerecorded Fast Scan programs. These programs are transmitted by remote call-ups via a 2 meter touchtone system. Meanwhile, incoming 10 meter Medium Scan is converted to Fast Scan and retransmitted on 70 cm with audio re-transmission on 2 meters. The user's remote terminal merely consists of a 2 meter HT and a portable tv (with 70 cm front end). Pursuing this idea a step further, we can envision expanding the system to include ATV repeater capabililities. Finally, we might pursue the concept which Adelide, Australia ATVers accomplished: a simulcast of 70 cm ATV on a locally unused UHF tv channel to allow the public at large to share our excitement. Envision those possibilities during times of crisis and emergencies.

The gang at JPL will soon be hitting the airwaves again (first of July) with Voyager II views of Jupiter and its moons. If you missed their fantastic array of pictures during Voyager I's flyby, here's your "second chance ". Don't miss it! Dick, K6SVP, is usually the SSTV operator, and he seems to favor 14,230 kHz during evening hours of weekdays and 28,680 kHz during midday hours of weekends.

Two sources, AMSAT Canada and AMSAT U.K. recently announced their intentions to include a working SSTV camera aboard future amateur radio satellites. This could be one of the most exciting times we've experienced in the OSCAR program. Imagine your own in-shack space observatory, and, assuming they implement this system exactly as I outlined it approximately 2 years ago, being able to control camera functions directly from your shack-located OSCAR satellite setup. Although my name somehow became disconnected with this SSTV/OSCAR interface and merge, I'm truly excited over its future aspects. Incidentally, my new book, "OSCAR: The Ham Radio Satellites" (TAB Books #1120), has just hit the newsstands, and I would like to thank everyone for their recent letters of support for that book.

The 1979 SSTV contest was highly successful, but its announcement in QST and CQ Magazines was somewhat a "blooper". QST ran the announcement somewhere in the back....under QCWA happenings or the like. CQ published wrong contest times. How they accomplished that is beyond me. CQ also refused to compensate for that mistake by contributing a single year's subscription to the winner abiding by the CQ rules. Brooks, W1JKF, and I had attempted to conduct this contest under International Slow Scan Society support. ISSS was loosing ground we hoped to revitalize it. Lordy! Next year, and during the ensuring years, we hope to again acquire the undying and reliable support of 73 Magazine. Roland Soucie, N6WQ, won the contest by a landslide - and he followed the right (published) rules of short hours! Watch for full contest results in 73.... and hope Wayne Green is still on our side (SSTV'ers et al) after this "blooper".

10 METERS DOING GREAT

Numerous amateurs, along with many Slow Scanners, have reported some outstanding band conditions recently on 10 meters. It's true-signals have been booming through from practically all areas of the world, and 200 watts is more than enough power to enjoy this activity. European signals have been peaking into the U.S. around 1500 to 1900 GMT and Japanese signals peak around 2200 to 0100 GMT. New Zealand and Australian signals usually peak from 0100 until the band closes, which has been as late as 9:00 p.m. local times. Clay, K6AEP, reports working numerous European and African amateurs on 10 SSTV, and analyzing their video with his SWTPC and CT82 intelligent terminal setup. Clay says this usually generates quite an interest in his setup. If you've wondered why Clay is so heavily involved in computer/SSTV activities, it might ease your mind to know he's one of the leading innovators and designers at IBM. I had the pleasure of comparing some professional-applications computer graphic ideas with Clay last year, and I found him to be a dynamic and brilliant individual.

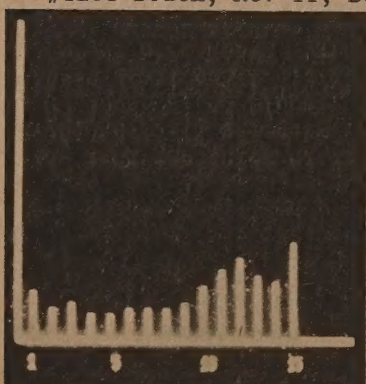
SSTV IN MONTANA

How many SSTV signals have you heard from Montana? Not too many, right? Maybe that situation will change in the near future. Dick, K7BON, in Billings, Montana, is trying to organize SSTVers in that area and coordinate some SSTV/ATV functions. Judging by the number of Montana stations operating 10 meter FM, this area seems quite motivated toward amateur frontiers such as SSTV. Dick's SSTV pictures in this issue's column were short using a polaroid 'scope camera he borrowed from work (hey, they're easy to make, gang, and they sure prove their worth when you want SSTV photos to share with others), and a Venus SSTV monitor.

LATER

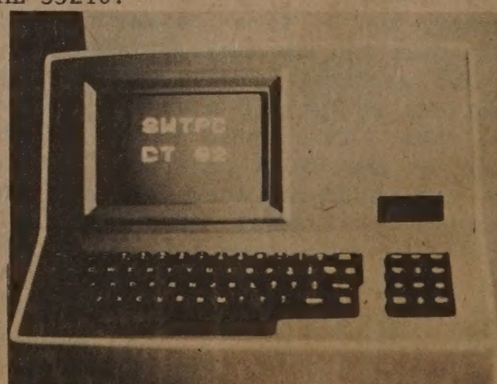
That "wraps up" the SSTV news for this issue, but please remember to send in your news, views and ideas. The last thing we need is a one-sided column, right?

The bands are alive and active these days, and on-the-air SSTV views are becoming more exciting by the day. If you haven't been enjoying SSTV operations recently, now's the time to fire up that rig and join the fun. We will see you on SSTV. 73, Dave Ingram,K4TWJ, Eastwood Village #1201 South, Rt. 11, Box 499, Birmingham, AL 35210.

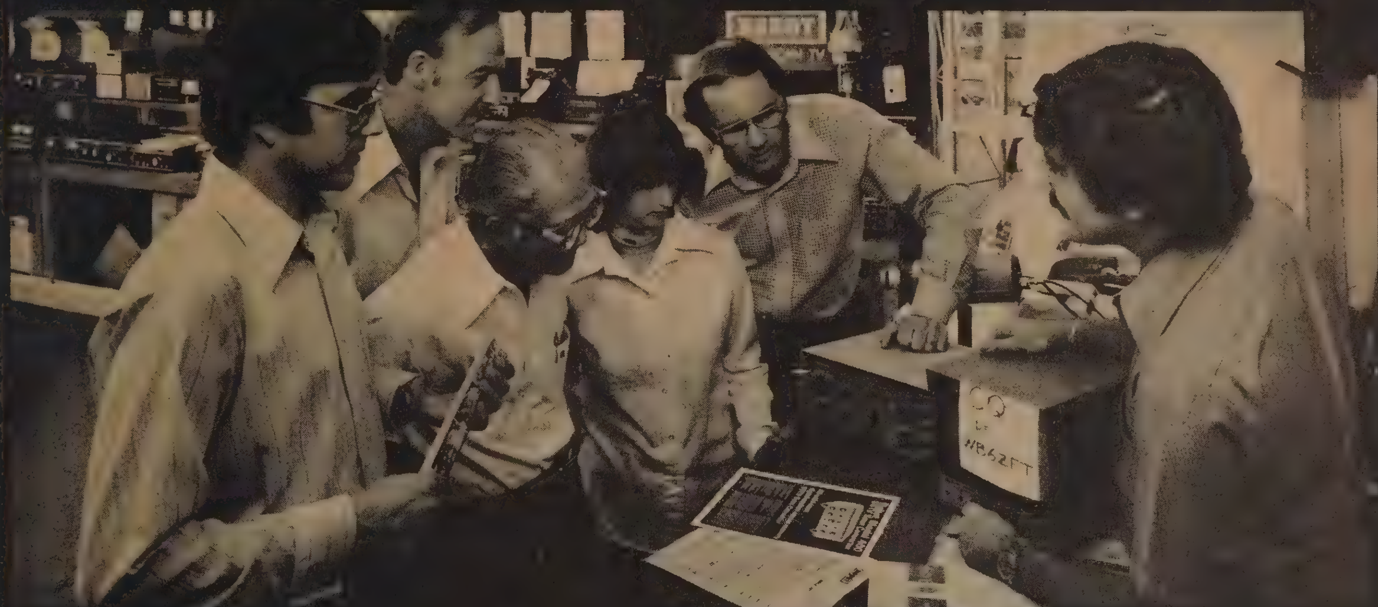


(Right) Here's K6AEP's SWTPC new intelligent terminal displaying some computer generated SSTV.

(Left) Histogram display of an SSTV picture as viewed on Clay's CT82 intelligent terminal. Display is number of pixels at each gray level (horizontal) versus gray level content (vertical).



ROBOT SSTV NOW AT YOUR HAM DEALER!



See him today for your Free SSTV Demonstration.

Now you can see what everyone's been talking about, and you can see it all right at your local amateur equipment dealer.

He'll be glad to demonstrate to you how simple it is to install SSTV in your station ...show you the high quality picture you get with the Robot 400, and let you see for yourself all the activity on the SSTV bands.

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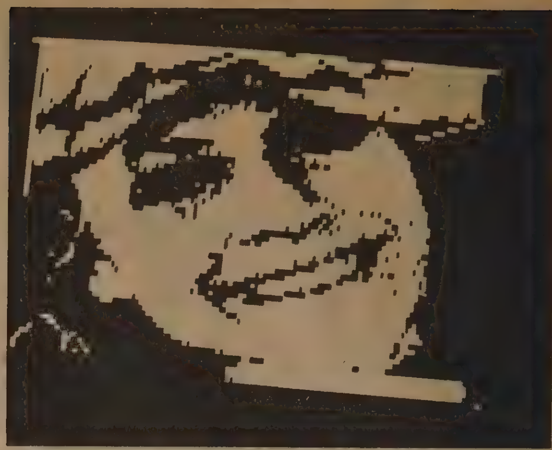
ROBOT

ROBOT RESEARCH INC.
7591 Convoy Court
San Diego, Calif. 92111 U.S.A.

This SSTV picture was produced with Clays SW & PC computer and his special interface card which mates the computer to his FSTV monitor. Clay reports outstanding results with this combination.



Same SSTV picture from KGAEP, but only 2 gray levels (black and white used). Picture density is 128 pixels on 64 lines. Interesting, eh?

SSTV views from K7BON in the rare state of Montana. Dick used a Polaroid camera and Tektronix mounting frame for the camera with his Venus SSTV monitor to snap these pictures. Nice. The Little Venus monitor is a real gem of P7 units. If you ever have a chance to check out one of these monitors, don't pass it up!

NEW ATV ANTENNA OFFERED

At the May meeting of the Midwest ATV club, the Shelby Indiana club President Ralph K9SEW showed a new antenna his group is manufacturing for 440 Mhz ATV. It is an extremely rugged antenna with a famaliar design. Built with tubular elements and square boom material, the antenna looks like two 10 element Yagi type beams but they share a common loop feed (much like the 8 over 8 design of old) It uses the skeletal slot principle and offers about 14 DB gain over a dipole. The unit is light but strong and is well made. The price is $25 each. The unit also uses a single feed point and does not require a balun. Write to Ralph at 1452 W. McKay, Shelbyville, IN 46176.

MORE COMMERCIAL ATV RIGS

Mike Silvernail WB4BNJ

Besides the recent entry of Xtronix and and System Electronics (see ad in this issue) yet another entry into the burgeoning field of ATV equipment. This one is from Florida and is made by Mike Silvernail. Don Miller showed the prototype at the Midwest ATV club meeting. The unit is made from existing kits of other mfgr, are all mounted in a "Regency HR-2" type box. The unit uses the Science Workshop varactor tuner, a Hamtronics UHF preamp, a GLB exciter an RCA "brick" amplifier a GLB audio board and other tiems. The front panel has a meter for transmit power and receive tuing (freq) indication, RF gain, mic gain, video gain and selection of transmitt or PTT. A novel approach, it is available ready made for 12V DC for $299., Write to Mike Silvernail at 14061 111th street, Largo, FL 33540. 813-595-3317

BRATS (Baltimore ATV RPT)

It is now possible to play TV paddle games through the ATV repeater. Transmit capability is not necessary to play ATV pong. All one needs is to receive the repeater and transmit a continous variable tone on 2 meters. The frequency or pitch of the audio tone controls the up/down position of the paddle. Video info from the pong game is transmitted from K3TAZ through the repeater. The right hand paddle is controlled locally by Fred (TAZ). You ctonrol the other pddle on 2 meters by an audio tone from 1.4 to 2.1 Khz. This will allow the left hand paddle to go from top to bottom. A single NE 555 chip is all you need to generate the tone for your rig and a pot to control tone/position.

The received audio is fed to a phase locked loop which converts the audio tone to a DC voltage which controls the left hand pong paddle.

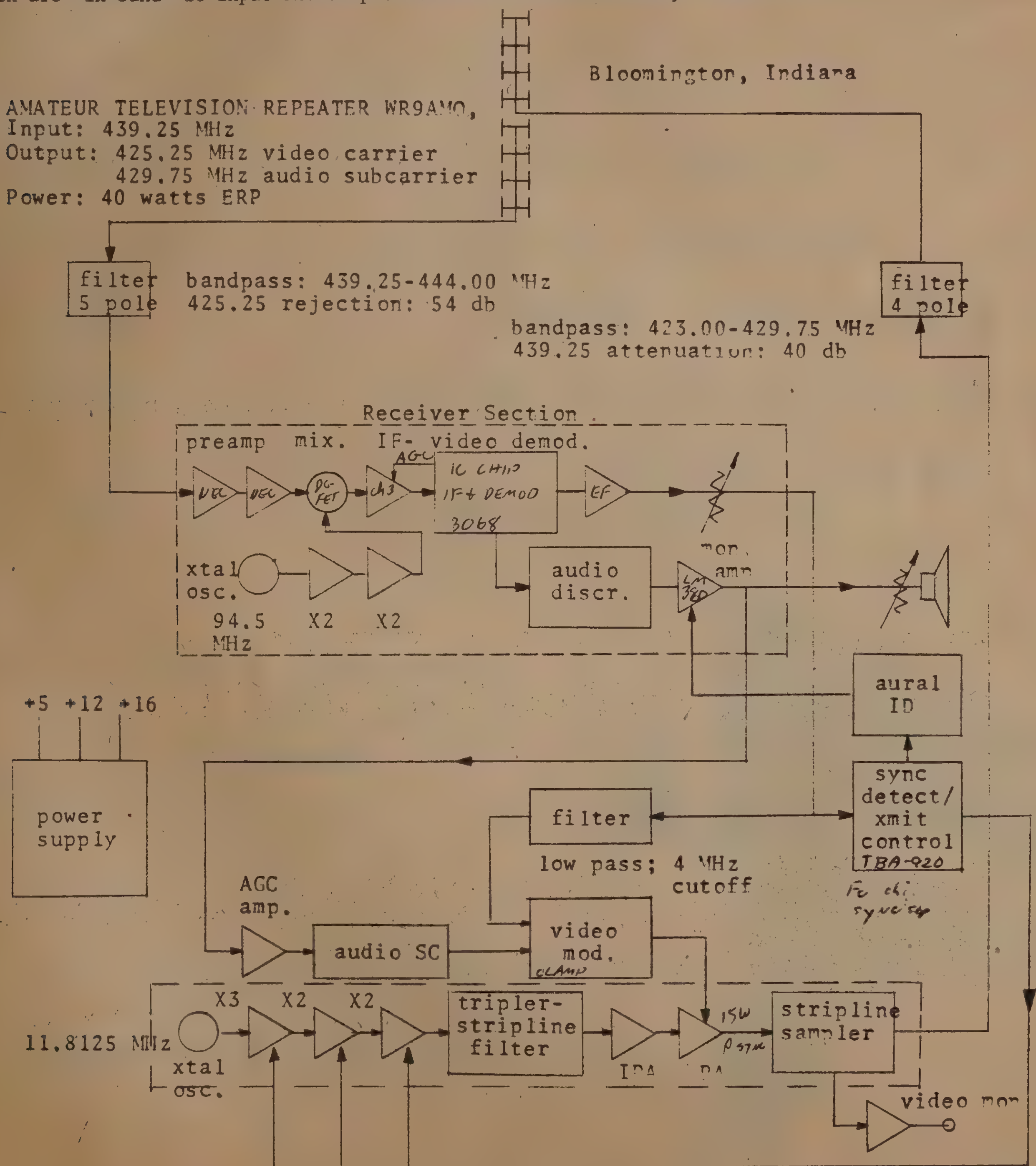
REPEATERS

Washington, DC's Metrovision and Bloomington, IN's WR9AMO provide the technical and user information you can use for your own ATV RPT system.

The Bloomington system was built and designed by Aptron Labs using their commercial equipment as the base of operations, and includes the special items necessary for ATV repeater operation. Their technical paper will provide you with the theoritical information you need to plan and understand the repeaters you may have built or plan to build.

The Washington group has been on for six years and has advanced well beyond simply repeating what it sees and hears. Their technical paper concerns itself with user controlled functions including access and use of the repeater's mini computer.

Both are "in-band" ie input and output are in the same ham band, 420-450 Mhz.



REPEATERS CONTINUED.............. WR9AMO

General. Line of sight conditions between transmitter and receiver antennas is very important. At ATV frequencies the level of field strength of the received signal will dimish substantially beyond line of sight.

It has been shown impericallv that field strengths very from theoretical calculations at the 420-450 Mhz band such that field strengths are only ,25 theoretical (and as low as .1) over hilly terrain or where obstructions such as buildings, etc., are in the path of the signal as is generally the case in urban areas.

Beyond line of sight signal strength varies as the 9th power of the distance instead of the square of the distance. Since the factor of distance appears in the denominator of the equations for field strength it is not difficult to understand why received signals experience heavy losses beyond line of sight.

Radio Line of Sight. The radio line of sight is somewhat fatther than optical line of sight and is based on 4/3 earth curvature. To determine radio line of sight between antennas of given heights use the following: 1.1 $D=1.414(\sqrt{T_a}+\sqrt{R_a})$

Where T_a and R_a are antenna heights of the transmi mitter and receiver if feet and distacd, D, is in miles. For example, if the transmitter antenna were 100 feet and rreceiver antenna at 30 ft. the radio line of sight would be about 22 miles:

$$D=1.41 \times (\sqrt{100}+\sqrt{30})$$

Calculating field strength. For the 420-450 Mhz frequencies the THEORETICAL field strength for line of sight conditions can be approximated by the following equations. Note that these equations have been arranged so that one can use feet and miles with the result expressed in volts per meter. and assumes 435 Mhz as the nominal frequency. (The results will not change appreciably in the 420-450 Mhz band.) 1.2

$$F= 94.577 \times 10^{-6} \frac{Ta\ Ra\ \sqrt{W}}{D^2} \text{ volts per meter}$$

F= field strength in volts per meter
Ta= transmitter antenna height in feet
Ra = receiving antenna height in feet
D= miles
W = transmitted ERP

Transmitted ERP is determined by taking the transmitter power times the antenna power gain less any line losses. For example if the transmitter produces 15 watts peak power, and the antenna has a gain of 7 db, and the line loses are 2 db...then the net antenna gain is 5 db which is a power gain of 3.16 times. The ERP would then equal 15 x 3.16 or 47.4 watts. We can rearrange equation 1.2 to solve for distance. 1.3

$$D= 2.14 \times 10^{-3} (\sqrt[4]{W})\left(\sqrt{\frac{Ta\ Ra}{F}}\right) \text{ miles}$$

Again dimensions are in feet, miles and F, field strength is in volts/meter. As state earlier, these theoretical field strengths are seldom realized in practice. This would be particularly true in urban areas where buildings and trees partially obstruct line of sight oonditions or where hilly conditions exist throughout the tertain covered by the repeater.

Most of the time we will find that about .25 theoretical will be the case even for line of sight conditions. The following equations have been corrected to account for this difference and are good approximations to the conditions generally found in practice. 1.4 1.5

$$F=(1.14 \times 10^{-6}) \frac{Ta\ Ra\ \sqrt{W}}{D^2} \text{ volts/meter}$$

or

$$D= 5.35 \times 10^{-4}\ 9\ \sqrt[4]{W})\left(\sqrt{\frac{Ta\ Ra}{F}}\right)\text{miles}$$

dimensions as before.

Equations 1.3 and 1.5 clearly point up that antenna height is far more important than transmitter power. The distance for a given field strength varies as the fourth root of the power but only as the square root of the antenna height.

Therefore if one has the option it is far better to raise the antenna height than to increase transmitter power. Of course increasing transmitter power helps and this can sometimes be obtained economically by using high gain antennas to raise the ERP level. Generally, however, the repeater antenna must be non-directional and it is expensive to obtain very large gains and still maintain omnidirectional patterns. One should also remember that while raising the antenna height helps more, the line lengths increase and very low loss line is required to avoid losing the advantage in line disapation. Finding an existing structure as a building is advantagous if the transmitter can be loeated on the roof or nearby to shorten line length.

Examples using the equations. Suppose you want to determine the distance to the 100uV/meter contour. If the repeater antenna is at 100 feet and typical receive antennas at 30 feet and the transmitter power is 15 watts, line loses are 2 db and the repeater gain antenna is 7 db. For the practical case using equation 1.5 we have:

$$A)\ D= 5.35 \times 10^{-4} (\sqrt[4]{47.4})\left(\sqrt{\frac{100 \times 30}{100 \times 10^{-6}}}\right) \text{ miles}$$

= 7.7 miles compares with 30.5 miles theo.

Next it is wise to check that line of sight conditions prevail for this contour...we know from our earlier example that the line of sight is 22 miles for these tower heights so we are okay.

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These same conditions would produce a 30.5 mile 100×10^{-6} contour if we used the theoretic cal propagation equations. This distance does exceed line of sight and we will discuss how to handle that later on in this discussion.

If we take the conditions of exampls (A) and change the antenna height by 10X, or change the transmitter power by **10 X** we can see the affect of each.

Raising transmitter power by 10X (ERP)

B) $$D = 5.35 \times 10^{-4} \left(\sqrt[4]{474} \right) \left(\sqrt{\frac{100 \times 30}{100 \times 10^{-6}}} \right)$$

$$= 13.7 \text{ miles (to the 100uV contour}$$

Raising the antenna 10 X

C) $$D = 5.35 \times 10^{-4} \left(\sqrt[4]{47.4} \right) \left(\sqrt{\frac{1000 \times 30}{100 \times 10^{-6}}} \right)$$

$$= 24.3 \text{ miles}$$

It is easy to see by comparing the results that raising the antenna height is far better than raising the transmitter power. If we take the results of (C) and check for line of sight we will find that for the 1000 ft / 30 ft condition, line of sight is 52 miles.

Beyond Line of sight Calculations. Now let's suppose that we have terrain conditions which are ideal as over very flat lands or over water and our propagation characteristics approach theoretical conditions. We will use the same example (A) where we find that the 100 uV contour is at 30.5 miles but line of sight is 22 miles.

We know that the 100 uV contour is somewhere between 22 and 30.5 miles. First we will determine what the field strength is at 22 miles using equation 1.2.

$$F = 4.577 \times 10^{-6} \left(\frac{100 \times 30 \times 47.4}{22^2} \right) = 192\text{uV}$$

Now, between 22 miles and 30.5 miles the signal st strength will be a function of the ninth power of the distance. The value of F beyond 22 miles is

$F = \frac{K}{D^9}$ and K at 22 miles is $192 \times 10^{-6} = \frac{K}{22^9}$

or $D = 22 \sqrt{\frac{192 \times 10^{-6}}{F}}$ since we want the answer for F = 100uV.

then $D = 22 \sqrt[9]{\frac{192 \times 10^{-6}}{100 \times 10^{-6}}} = 23.7$ miles.

One of the most important exercises is to determine what the likely S/N ratio at the receiver will be at the ATV receiver output with a given antenna height at the repeater with a given transmitter and antenna.

It is generally accepted that a picture with 52 db peak signal to rms noise is essentially noise free to the majority of viewers. A picture with 40 db S/N is very useable but has visable noise which is not too objectionable for the average viewer. We should design for a minimum of 40 db for the outlying areas of our coverage if possible. Anyone closer will have better than 40 db S/N in general.

Determining S/N. In order to achieve a 40 db output S/N from the ATV receiver the input signal to noise has to be 43 db. If the noise figure of the receiver were 10 db then we would need an input signal to noise of 50 db. Assuming 50 ohm impedance for our receiver and antenna system we can begin calculating the required field strength and transmitter power needed to achieve 40 db output S/N at the receiver.
The thermal noise voltage at the receiver input terminals is: 1.6

$$E_t = 1.28 \overline{/,5R9bw)} \times 10^{-10} \text{ volts}$$

Where R is the impedance, (bw) is the bandwidth of the signal. The noise power is: 1.7

$$W_t = \frac{E_t^2}{.5R} = 1.64 \times 9bw) \times 10^{-20} \text{ watts}$$

Assuming a receiver with a 3 db noise figure we need 43 db input signal to noise which is about 141 times more than theoretical zero noise. The signal power we need is then: 1.8

$$W_s = 141^2 \times W_t = 141^2 \times 1.64 \times 10^{-20} \times (bw)$$

$= 3.26 \times 10^{-16} \times (bw)$. For our TV signal (bw) equals 4×10^6 hertz.

$$W_s = 1.3 \times 10^{-9} \text{ watts.}$$

Now to take a realistic example, lets assume that we wish to cover a 15 mile radius with our repeater and our repeater antenna is 120 feet, that the receive antenna is at 45 feet. Furthur let's assume our net gain for the repeater antenna which is omnidirectional is 5 db which is a power gain of 3.16 times. We aee going to determine the transmitter power required to produce a signal power at the receiver producing 40 db output signal to noise. We will assume propagation characteristics .25 theoretical and in areas (flat) where better propagation exists better results will be obtained. Let's start by assuming a dipole antenna at each end. Then the field strength is approximately as follows at the receive antenna:

$$F_r = \frac{(7.9 \times 10^{-7})(120 \times 45)(\sqrt{W})}{\lambda \times 15^2} = \frac{1.896 \times 10^{-5} \sqrt{W}}{\lambda}$$

If the receiver antenna is a halfwave dipole matched to the receiver then the voltage at the receiver terminals is: $\frac{F_r \lambda}{2 \pi}$

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witch used to manually select channel.
, digital read-out indicator shows crystal

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2 MTR.) HAM BANDS!

Any 4 crystal-controlled FM channels in the following frequency bands:
* [VHF low band] 30 to 50MHz, Total Spread 8MHz
* [VHF high band] 150 to 174MHz, Total Spread 8MHz
* [UHF band] 450 to 470MHz, Total Spread 8MHz

0.5μV for 20dB quieting
60dB down at ± 25KHz
50ohm (impedance)
30dB, 1μV, 1KHz at 5KHz deviation
15KHz (-6dB)
1st IF: 10.7MHz, 2nd IF: 455KHz
More than 70dB
2 watts maximum (V.C. imp. 8 ohms)
More than 55dB
Approx. 15 channels per sec.
Less than 500 miliamperes
Operates from 11.5 to 14.5 volts DC Negative Ground only
6-1/4" (W) X 8" (D) X 2-1/8" (H)
4 lbs.

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MODULES

les for the front end, permitting any unit
le bands.

receiver.
ng module plate.
to the terminals on the module.

ing) the leads to corresponding terminals
een connected to their proper terminals,
of the four screws previously removed.

SEMICONDUCTORS

MAY BE USEABLE AS ATV CONVERTER?? 432 TO CHAN. 2 ??

UHF TUNER — Double conversion front end.

Q101	2SC1070, UHF RF Amp.
Q102	2SC288A, Converter (56MHz) 1st IF ▲
Q103	2SC838, 1st Local Oscillator (45MHz)
Q104	2SC839, Tripler (135MHz)
Q105	2SC387A, Tripler (405MHz)
Q106	2SK23A, 1st Mixer (10.7MHz) 2nd IF
D101 —	D104, 1S1555 Switching Diode

VHF HIGH BAND TUNER

HI-VHF-RF MODULE 9.95

Q101	3SK39, VHF RF Amp.
Q102	2SC838, 1st Local Oscillator
Q103	2SC839, Tripler
Q104	2SK23A, 1st Mixer (10.7MHz)
D101 —	D104, 1S1555 Switching Diode

IF & AUDIO SECTION

Q301	2SC838, 2nd Mixer (455KHz)
Q302	2SC838, 2nd Local Oscillator (10.245MHz)
IC301	TA7060P, 2nd IF Amp. (455KHz) 3rd. IF (UHF)
IC302	TA7061AP, 2nd IF Limiter
D301 &	D302 1N60, FM Detector
Q303	2SC900, Audio Amp. & Squelch Gate Control
IC303	TA7062P, Audio Driver Amp.
Q304	2SC900, Squelch Noise Amp.
Q305	2SC900, Squelch Noise Amp.
Q306	2SC945, Squelch Switching.
Q307	2SC945, Squelch DC Amp.
D303	1S1555, Temperature Compensation
ZD301	AW-01-09, AVR
D304	F-14A, Polarity Protector
TH301	19D-47, Audio Power Amp. Temperature Compensation
TH301	19D-47, Audio Power Amp. Temperature Compensation
Q1	2SC1096, Audio Power Amp.
Q2	2SC1096, Audio Power Amp.

AUTO SCAN SECTION

Q201	2SC945, Multi-Vibrator
Q202	2SC945, Multi-Vibrator
Q203	2SC945, Vibration Stoper
IC201	μPB213C, Flip-Flop
Q204	2SC945, Logic Circuit
Q205	2SC945, Logic Circuit
Q206	2SC945, Logic Circuit
Q207	2SC945, Logic Circuit
Q208	2SC945, Master Switch for Channel 1
Q209	2SC945, Master Switch for Channel 2
Q210	2SC945, Master Switch for Channel 3
Q211	2SC945, Master Switch for Channel 4
Q212	2SC509, AVR
ZD201	RD6A, Zener Diode for AVR

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The granddaddy of all ATV repeaters WR4AAG is now 6 years old and has been in continous operation since its first STA. They have also gone through more equipment changes than any other repeater, each time increasing user services, service range, capability and reliability. For some time now, the WR4AAG users have enjoyed the use of a computer which is an integral part of the ATV repeater system/control. The particulars of this sophisticated operation follow:

Specifications: Uplink (user to computer) 439.25 Mhz FM 5 Khz deviation
Modulation AFSK, high tone 2200 Hz 'space' or logic level '0'. low tone 1200 Hz 'mark' or logic level '1'. Speed 10 characters per second (maximum) Format (character contents)=
1. start bit '0' level @ 9.09 msec.
8 information bit '0' or '1' level @ 9.09 msec each; 2 stop bits '1' level @ 9.09 msec each. baud rate = 110 baud. Total time to transmit one charracter = 100 msec.
Downlink (computer to user) 427.25 Mhz AM TV 4 Mhz bandwidth. Displayed on user's TV receiver in standard 525 format. Character generator = 10 rows, 16 columns. Four pages of display accessed in sequence.
Computer hardware, uses Intel 8008 CPU instruction set; 1536 bytes of 1702-A UV EPROM memory (control programs); 2048 bytes of 2102 A RAM (user programs); frequency demodulator (WØLMD band pass active filter design); frequency modulator (for computer dumps to magnetic tape) analog to digital converter (for measuring signals).
User components; operational ATV station; Metrovision keyboard modulator (aprox $30), audio tone output is fed into mike input of ATV transceiver); keyboard, computer surplus or new, keys must be encoded on the keyboard; keyboard must generate a "key depressed" signal, available from many sources advertised in various magazine tape recorder (optional) used for program storage. NOTE you do NOT need the following to use the computer: TV typewriter character generator, teletype, UART, modem/data set. If you do have any of these already, so much the better but they are not really necessary to use the Metrovision's computer.

Keyboard modulator parts list and instructions are available from Bruce Brown 4801 N. Kenmore # 1022, Alexandria, VA 22304. Keyboard modulator printed circuit board is available from Stu Mitchell, 14761 Dodson, Woodbridge VA 22191.
PURPOSE: (A) allow users to gain knowledge in micro/mini computer techniques (B) saves user $500 and up in private purchase of computer (C) display relative signal strength and frequency of user's signal permitting transmitter and antenna tune-ups without need for expensive calibration gear. (D) display relative output power of the repeaters audio and video transmitters. (E) display time and video ID for the repeater (F) monitor the repeaters equipment for malfunction. (G) control the on/off times of the repeater automatically, adjusting to time changes in the spring and fall. (H) permit users to write and execute various programs: message center for metrovision members; oscar orbital data generator; slow scan to fast scan TV conversion; games (hi-lo space capture, others now available)
OPERATING PROCEDURE. Key repeater to insude it is on the air and your equipment is working. Remember to ID and check for other repeater users. Disconnect microphone and connect keyboard modulator to mic input. Key transmitter and type in password (password * WR). Release PTT switch to view the repeater if you do not have full duplex the repeaters video transmitter will remain on with the audio channel supressed. The screen should clear except for an * in the upper left hand corner of the screen. A white square will appear to it's immediate right. This is the computer display cursor. Now you are all set. After every * you can give any disired system command as follows:

COMMAND	FUNCTION
L	"list" memory contents on display in octal
E	'execute" a program from memory
P	"program" memory from keyboard input in octal
R	"run" program ID by additional characters
B	"bye" end of use, turns off computer
CNTL+SPACE	"ESCAPE" turns off the computer

At ten minute intervals, remember to ID and check for other rep-ater users.

TYPICAL DIALOG FOR SYSTEM COMMANDS :

A LIST : * L user types L

L 000 CR user types low starting address

H 010 CR user types high starting address

The computer will now display data in octal starting at the specified address and continuing for 7 locations. If a mistake is made while typing an address, a space should be typed instead of a CR. The address will be ignored and the computer will display a * again.

High address	low address	data at that address
010	000	321
010	001	103
010	002	206
010	003	301
010	004	102
010	005	123
010	006	321

B. EXECUTE : * E user types E

L 000 CR user types low starting address of program

H 000 CR user types high starting address of program

REPEATERS CONTINUED.........BLOOMINGTON

Therefore $E_s = \frac{1.896 \times 10^{-5} \sqrt{W}}{\lambda} \times \frac{\lambda}{2\ pi}$

$= 3 \times 10^{-6} \times \sqrt{W}$ The received signal power is

$W_s = \frac{E_s^2}{.5\ R} = \frac{(3 \times 10^{-6} \times \sqrt{W})^2}{25} = 3.6 \times 10^{-13} \times W$

Equating the above with 1.8 we have:
$3.6 \times 10^{-13} \times W = 1.3 \times 10^{-9}$ or

3.6×10^3 watts (using dipole antennas)

Now the power gain of our transmitting antenna is 3.16 times and assuming our receiver antenna has a gain of 13 db or 20 times , the total antenna gain is 63.2.

so $\frac{3.6 \times 10^3}{63.2}$ = 57 watts transmitter power. required to produce the 40 db S/N at the output of the receiver which is 15 miles from the repeaterwith the assumptions used. If the repeater antenna is raised higher the transmitter power is reduced even furthur. The receiver antenna system can be even high in gain than the example typically 17-19 db since it can be directional. Raising the receiver antenna also is advantagous since obstacles reducing field strength may be avoided in some cases. Had we assumed theoretic cal propagation characteristics we would find the transmitter power required to be only 3.5 W.

If the repeater antenna is 120 to 200 feet high and the receive antennas 30-45 feet high we find a 15 watt transmitter used with an omni-directional antenna with a gain of 7 db and low loss line (1 db/100 feet) will generally provide excellent signal to noise pictures 10-15 miles from the repeater. We cannot anticipate all the vagaries of propagation between receiving sites even where all conditions of reception seem to be equal. Certainly the higher the receive antenna the more likely it will be that conditions will permit consistant reception. Raising the transmitter tower, even 10-20 feet will help substantially.

Good engineering practice i assembling the connectors on the transmission line and antennas is vital. It is very easy to introduce 1-2 db l loss by poor connector assembly. Remember 1 db is 1.122 times. A 202 uV signal becomes a 180 uV signal and can make the difference between a marginal picture S/N and a very useable S/N.

As a general rule try to design for at least a 200-300 uV signal at the majority of the receiving locations...try to elevate the repeater antenna and receiver antennas as high as practical...keep line losses and connector losses to a minimum ...try to get over or to the side of obstacles with the receive antenna optical line of direction to the repeater...keep in mind that filtering (always needed) introduces losses and the need to elevate antennas is more important than raising transmitter power.

FCC CRIB SHEET
(TNX to BRATS "Milliwatt")

We managed to swipe a copy of the new FCC EXTRA CLASS exam, part of which is printed below. Apparently a lot of emphasis is placed upon schematic representations of various types of grounding methods. This portion of the exam requires you to match the symbol with the correct nomenclature.

____GROUNDHOG	____FLOATING GROUND
____COFFEE GROUNDS	____GROUNDWORK
____RF GROUND	____GROUND GLASS
____GROUNDPLANE	____LEGAL GROUNDS
____DC GROUND	____GROUND LUG
____GROUND BEEF	____GROUND SPEED
____GROUND BALL	____GROUND RULE
____GROUND WAVE	____FOREGROUND
____BACKGROUND	

(ed note:)

When questioned about the legal grounds for such an exam, we were told that our objections were groundless. Until we could come up with arguments on other grounds we would have to use these unless we could find a common ground. We suggested that the tone of the conversation was in need of static drain, but this idea was grounded!!!!

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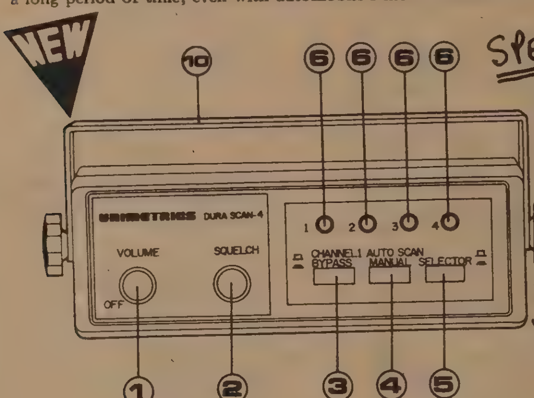
COMPLETE SCANNERS SHIPPED WITH 37 PAGE OPERATING & SERVICING MANUAL, FUSED POWER C

GENERAL DESCRIPTION

The UNIMETRICS DURA SCAN-4 is a compact all solid state FM receiver capable of automatically scanning up to 4 crystal controlled channels in either the 30-50MHz, 150-170MHz, or 450-470MHz bands, as determined by the RF module inserted into the front end. In the automatic scanning mode, the receiver will continuously scan up to 4 channels in the selected band, locking onto the first channel on which a voice transmission is received. Upon the cessation of the transmission, automatic scanning will resume until another transmission is received on one of the channels. An instant reading, digital read-out indicator shows the channels being selected at all times. A "lock-out" switch for the first (1) channel permits skipping of this channel you do not wish to scan or monitor. The receiver can also be operated in the manual mode to select any desired one of four channels. Interchangeable RF modules permit the receiver to be operated on any of the three bands mentioned above.

Designed and built for reliable, trouble-free performance, the receiver uses rugged heat-resistant transistors, ICs and dual gate FET in all critical areas. Silicon transistor is used in the oscillator circuit, a mos-FET in the RF stage, and ICs in several stages such as IF stages, audio circuits and automatic scanning circuits. Current drain on 13.8 volts DC is exceptionally low, permitting continuous monitoring in mobile operation for a long period of time, even with automobile's motor switched off.

NEW



SPECIAL! BRAND NEW!! ONLY 24.95 MONEY BACK GUARANTEE!!

Figure 1
FRONT PANEL

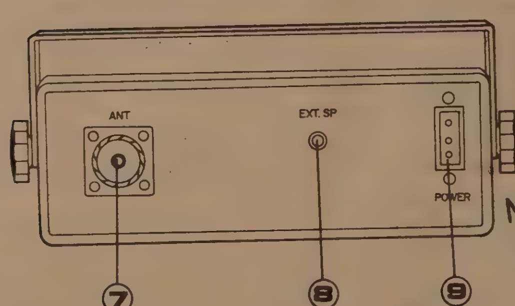


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Figure 2
REAR PANEL

OPERATION CONTROLS AND FEATURES

1. OFF/VOLUME - turns the power on or off and varies sound output from the speaker.
2. SQUELCH - This control is used to "quiet" the receiver during "no signal" conditions. Degree of sensitivity to incoming signals is adjustable. Full clockwise provides maximum squelch.
3. CHANNEL 1 BYPASS SWITCH - This switch depressed in position permits skipping of the first channel during autoscanning or manual modes of operation.
4. AUTO SCAN-MANUAL SWITCH - Selects mode of operation for the receiver, either automatic scanning or manual selection of the channels.
5. MANUAL SELECTOR SWITCH - This
6. CHANNEL INDICATORS - Instant-read position selected (one through four).
7. ANTENNA CONNECTOR - For anten
8. EXT. SPEAKER-PHONES - Allows use external speaker for remote operation. internal speaker.
9. DC POWER CONNECTOR - DC power r
10. MOUNTING BRACKET - Specially de under the dash – has "quick-release" fe

WARNING: YOU'LL KICK YO MISS OUT ON THIS ONE!

SPECIFIC

COVERS UHF (+ HI-VH

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INTERMEDIATE FREQUENCY . . . . . .
SPURIOUS RESPONSE REJECTION . . .
AUDIO OUTPUT . . . .
IMAGE RESPONSE REJECTION . . . . . .
SCANNING RATE . . . .
CURRENT DRAIN . . . .
POWER SOURCE . . . .

DIMENSIONS . . . .
NET WEIGHT . . . .

RECEIVERS ARE SUPPLIED WITHOUT C

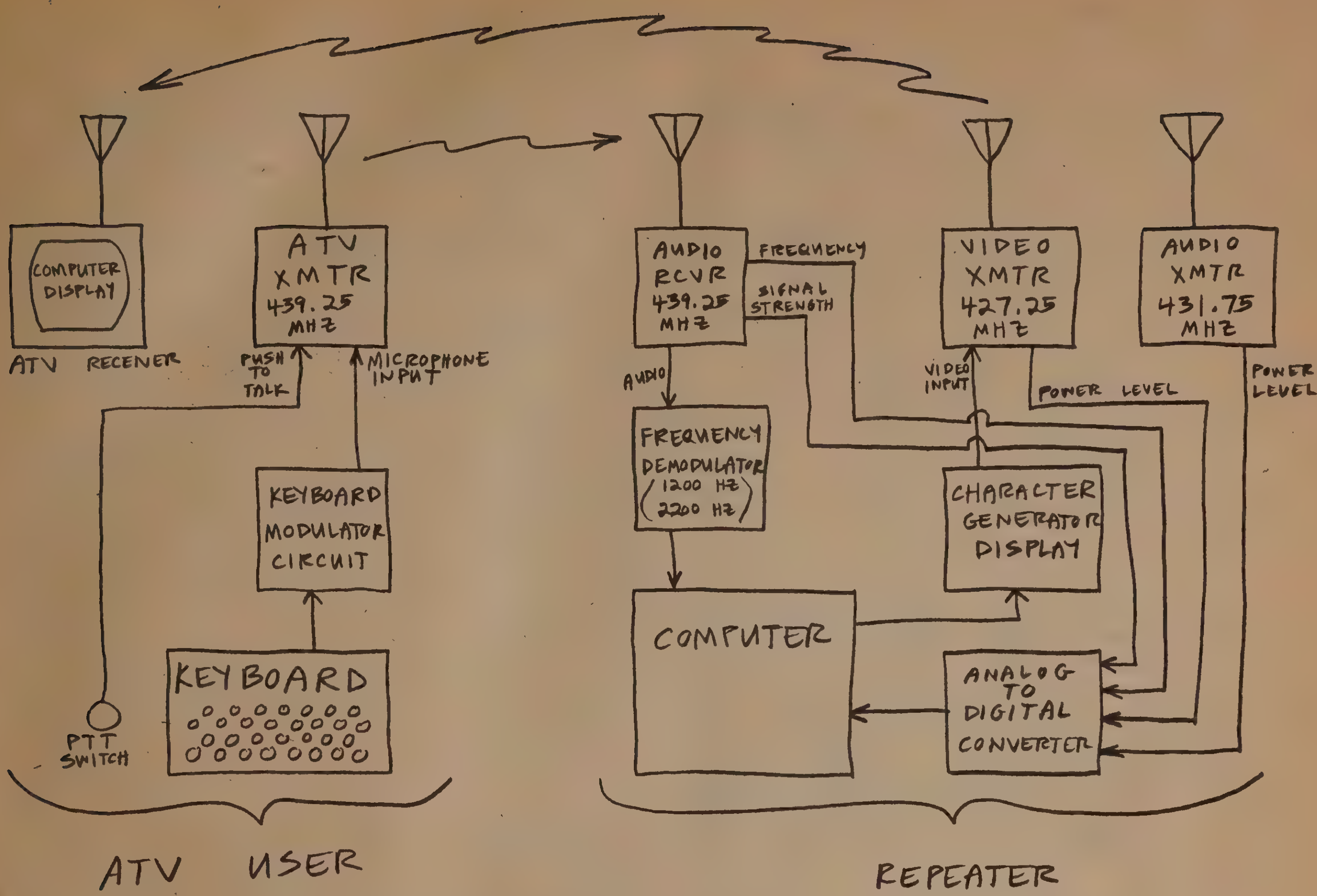
* Operation on any of these three bands RF modules in the front end. Addition shipped with one module UHF

CHANGING I

This receiver features interchangeable RF m to be operated on any one of the three ava

To replace RF modules, proceed as follows:

1. Remove the top and bottom cover of
2. Remove 4 screws at side of receiver bo
3. Unsolder and remove the leads connec
4. Remove existing module.
5. Insert the new module, attaching (sol on the module. When all leads hav secure the module in place by mes



BLOCK DIAGRAM OF SYSTEM

The program at the specified address will then be executed- - that's it !! As before, if a mistake is made, type in a space instead of a CR and the computer will display a * again.

```
PROGRAM:   * P        user types P
         L 000 CR     user types low starting address
         H 010 CR     user types high starting address
                      starting address is the address
                      where your program will start

    ADDRESS

010  000  321  CR  The computer will automatically
010  001  103  CR  increment the address.
010  002  123  CR
010  003  206  CR  user types in 3 digit octal data
010  004  301  CR  and a carriage return.
```

D. RUN : * RWR4AAG CR The 'WR4AAG' id program will then be executed and will display the rpt ID on the character generator.

NOTES

1. No error statements are provided by the computer. During your program development it may be useful to liberally insert "000" (halt) and/or "123" (output accumulator) instructions to permit step by step program monitor The "snap shot" subroutines are also available which are essentially breakpoint register dumps. The use of these are more fully described in the "user available subroutines" section of this guide.

2. If your program goes into a loop or becomes unresponsive due to a programming error, press the "escape" key (control + spcae) on your keyboard. This provides a hardware system re-start which will turn off the computer. To re-start your program just type in the password again and continue. Previously stored data will be retained until written over (either manually or by the oomputer).

3. When generating a character from a program (as opposed to directly from a keyboard) use a complimentary octal form. For instance, a program that will print the latter "A" would be written as follows:

```
006  (load accumulator with...)
276  ("A" complimented = 10 111 110)
123  (output the accumulator to the character gen.
```

or

```
006  (load accumulator with...)
276  ("A" complemented = 10 111 110)
075  (output the accumulator to the charatter gen
      with a time delay)
```

REPEATERS CONTINUED........METROVISION

The complementary form is used since this is the format that the computer's character generator di display accepts. The output of your keyboard is (may) also be in a complementary form. Although not necessairily. This is the reason that the keyboard modulator has the option of selecting normal or complemented keyboard data.

Special control keys used for character gen display.

KEYS	FUNCTION	OCTAL CODE
CTL + C	PAGE TURN	374
CTL + D	CURSOR UP	373
CTL + H	BACK SPACE	367
CTL + I	CURSOR HOME	366
CTL + SPACE	"ESCAPE (off)	377
SLASH (/)	PAGE ERASE	320

PROGRAMS

To call up a program, type the password, followed by R (run). Then type the program name followed by a carriage return. All programs are sumarized below:

1. CHARGE (CHARacter GEnerator

This program permits you to write messages on any or all of the four pages of the repeater's character generator. A) / performs a sofeware erase of a page. B) program is terminated by pressing ESCAPE button on your modem.

2. WRITE

Same as above but message is also stored in any desired location of the computers RAM memory. A) After typing WRITE followed by CR, enter low address (in OCTAL), CR, high address (in octal) CR. The low and high address is the start location of the message. B) Program is hung-up by pressing > (greater than) This character is stored in memory before the program ends. C) The software erase function / is not operative in this program.

3. READ

Recalls message stored in memory by WRITE pgm. A) After typing READ followed by CR, enter message start locations as described in A above. B) Program will hang up if it reads the > symbol from memory. C) If a / symbol is encountered in memory, the computer will treat it as a RETURN (007) instruction. Thus the READ program can be used as a subroutine. See subroutine summary.

4. SIGNAL

Displays your relative signal strength in a three digit octal number. A) Type A to automatically initiate periodic samples at 2 second interval vals. B) Type S to initiate manual sample. Typing any other characters will have no effect on the program operation, however they will be printed on the display. (Useful for typing notes preceding manual sample) C) Program is hung up by pressing ESCAPE button on modem.

5. POWER

Displays power output from audio transmitter under A column and power from the video transmitter under the V column. A calibration table is required to convert the 3 digit octal numbers displayed directly into watts.

6. WR4AAG

Prints station ID on two consequitive pages of the character generator.

7. CQER

Displays animated CQ ATV sign along with your call letters. To start program, type CQER CR, your call letters, CR. Program is hung up by pressing ESCAPE button on modem.

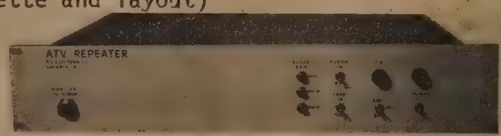
8. XX,XXX,XXXX,XXXXX,XXXXXX; X = any character

After typing any 2 through 6 character word excluding previously described program names, flolowed by a CR the computer will search throughout its RAM memory for that word. If it finds the word, all characters that follow it in memory will be printed until a symbol is found which will hang up the program. If a / symbol is encountered printing will stop however the computer will not hang up. A new program name may now be entered. If during the search process no match up is fount TILT will be printed. The computer will not hang up after a TILT a new program name may then be entered.

continued next page.........................

DAYTON SHORTS

P C Electronics has some new products, of which their repeaters were described in their ad last issue. However, somewhere along the line the picture which was supposed to be in the ad was lost, so here is the picture of the PC Electronics ATV repeaters. (Both models use the same type cabinette and layout)



P. C. Electronics — TVR-12 Crossband Repeater 4/79

PC also has some new items, including a super low noise (.9db nf) preamp which is part of the tuneable receive converter TVC-1B. The FM subcarrier sound generator which was already a great product now has an on board 8 volt regulator so you can run it stright from the DC supply used to power other modules. The TVG-12 is a new 1240 Mhz receive converter in a dicast box for at the antenna mounting. At Dayton Tom had the color camera on display and with the 3 electrode vidicon, the color was outstandingly good. Even in the poor light conditions of the display booth, the camera provided excellent pix despite a 2 F stop handicap (light level was 2 F stops below recomended lowest light level). A real exciting unit was a new self contained 450 power amp, specially built for ATV with 60 watts output power, built in AC supply, full metering fan, antenna relays, and only 22 pounds for $330 ready to plug and play.

USER AVAILABLE SUBROUTINES

Start Address High	Start Address Low	TITLE	DESCRIPTION
000	000	Hang-Up	Turns off computer
000	027	Print H & L	Binary data in H and L registers is printed in octal. Registers A, B, and E are destroyed.
000	040	Set H & L Regs.	Permits setting of H & L registers by entering octal numbers from keyboard. Registers A,B,C & E destroyed.
000	062	Increment H & L	Increments L register by 1. Increments H register by 1 only if L register was 377. No registers destroyed.
000	070	Output Delay	40 msec delay followed by an output of character in A register. Register E is destroyed.
000	103	Run *	Returns computer to wait for a new command
000	200	Input Format	Converts 3 digit octal number entered by keyboard into 8 bit binary number entered into the B register. Registers A, B, and C are destroyed.
000	256	Output Format	Converts 8 bit binary number in B register to 3 digit octal number displayed on character generator. Registers A and E are destroyed.
000	344	Page Erase	Character generator software page erase. Cursor is placed in the upper left hand corner of page. (HOME) Registers A and E destroyed.
005	051	Read Out Message for Display	All memory will be read consecutively and displayed on the character generator until a / symbol is read which will return computer to calling program, or until a symbol is read which will turn off computer. The H and L registers (starting address) must be set in advance. Register E is destroyed.
005	250	2 Sec. Delay	Subroutine waits for 2 seconds and then returns to the calling program. Registers A and E are destroyed.
005	252	Universal Delay	Depending upon the value of the A register, a time delay of 50 msec to 4 seconds can be generated after which this subroutine returns to the calling program. Registers A and E are destroyed.
006	000	Search	This routine called up by user typing in an R from keyboard for a command. A 2 to 6 character word plus carriage return is entered from user's keyboard, after which this subroutine searches all RAM memory for that word. Once the word is found there are two possible alternatives. If the fourth through eighth bits in the next consecutive address are zeros, it will treat that next address data as a high address and the following address data as a low address and jump to that address. If those bits are not zeros all memory will be printed on the character generator until a / symbol or a > symbol is read which will stop memory readout.

EXAMPLE :

High	Low	Data	Meaning	
001	002	271	F	Program Name
	003	263	L	
	004	276	A	
	005	254	S	
	006	267	H	
	007	002	High Address	Beginning Of Program
001	010	000	Low Address	

USER AVAILABLE SUBROUTINES

Start Address		TITLE	DESCRIPTION
007	130	Snap-Shot A thru E	This subroutine will display on the character generator display the contents of the A, B, C, D and E CPU registers AT TIME OF ENTRY into this subroutine. When finished, this subroutine returns the computer to wait for another system command. (*)
007	300	Snap-Shot H and L	This subroutine will display on the character generator display the contents of the H and L CPU registers AT TIME OF ENTRY into this subroutine. When finished, this subroutine returns the computer to wait for another system command. (*)

These subroutines are useful in de-bugging a program. Simply insert a jump instruction in the program being de-bugged to jump to these subroutine start addresses. Insert the jump instruction where ever you might suspect a problem. Then compare the "Snap-Shot" register results with what is expected to happen in your program. Also remember that HALT (octal 000) and DISPLAY (on character generator) (octal 123) commands are useful in de-bugging programs. Just insert the desired instruction where you may suspect a problem. Don't forget to remove these test instructions after the problem has been found......

EXAMPLES :

High	Low	Data	
001	007	104	(jump)
	010	103	Low
001	011	007	High

A thru E Snap-Shot

High	Low	Data	
001	007	104	(jump)
	010	300	Low
001	011	007	High

H and L Snap-Shot

High	Low		
014	000	Keyboard Decimal to B C D	A three digit decimal number (not greater than 255) is taken from keyboard input, converted into binary coded decimal and placed in CPU registers B, C, and D. Register B contains most significant digit, C is second significant digit, D is least significant digit. The keyboard input must be three digits and must be 000 through 255 or this subroutine will turn off computer. Register A is destroyed. BCD result in B, C, & D regs.
014	112	BCD to Binary	Binary coded decimal digits in registers B, C, and D is converted into binary data and placed in the E register. Any number higher than decimal 255 (octal 377) will result in this subroutine turning off the computer. Register A is destroyed.
014	200	Binary to BCD	Binary Data in the D register is converted into binary coded decimal data and is placed in registers B, C, and D. Register B is most significant digit, C is second significant digit, D is least significant digit. Register A is destroyed.
014	324	BCD to Character Generator Output	Binary coded decimal digits in registers B, C, and D is displayed on the character generator. Register B will be displayed first, register C will be to it's immediate right on the screen, register D will be to the immediate right of register C on the screen. Register A is destroyed.

VII. MEMORY ORGANIZATION OF THE COMPUTER

Starting Address		Ending Address		Memory Type	Purpose
High	Low	High	Low		
000	000	000	377	PROM	Executive Control
001	000	001	001	RAM	Executive Control
001	002	001	377	RAM	Member's Use
002	000	002	377	RAM	Member's Use
003	000	003	377	RAM	Member's Use
004	000	004	367	RAM	Member's Use
004	370	004	377	RAM	Executive Control
005	000	005	377	PROM	Executive Control
006	000	006	377	PROM	Executive Control
007	000	007	377	PROM	Executive Control
010	000	010	377	RAM	Member's Use
011	000	011	377	RAM	Member's Use
012	000	012	377	RAM	Member's Use (CQ'er)
013	000	013	377	RAM	Member's Use (CQ'er)
014	000	014	377	PROM	Executive Control
015	000	015	377	PROM *	Executive Control

* Future Addition

SILENT KEY

On April 22nd, Amateur Radio lost one of its most active and progressive pioneers..... Charlie Spitz, W4API, of Arlington, VA .

First on the air as a lad in New York, Charlie had been continously active as an experimenter and an operator throughout his entire 60 years in amateur radio. Charlie had a variety of calls including W6FZQ, W5QML, W7JHS, F7AF and LJ2Z. Charlie also served overseas as a colonel in the US Air Force. During the mid 30's Charlie was a prominent DXer and served for a number of years as manager of the 6th call area QSL bureau for the ARRL.

A proficient CW operator, Charlie throughout his careet leaned consistantly toward the experimental frontiers of ham radio, beginning with early construction and testing of HF directional antennas (when most hams were depending upon Zepps and doublets) to energetic exploration of VHF and UHF techniques. He was one of the first to operate on 220, 450 and 1296. In 1976, he was the recipiant of the A5 Magazine, "Good Image Award" for his contributions to the advancement of ham TV. Charlie was a life member of both ARRL and AMSAT.

In the early 1960's Charlie served with the FAA as Chief of the Plans and Requirements Branch of the International Aviation Service. He subsequently represented the Raytheon Co. in Washington for a number of years. In his most recent role as Legislative Chairman for the Metrovision ATV Club, his excellent writing ability and knowledge of government were significant factors in bringing about rulemaking that enabled ATV to continue to function. A staunch advocate of consumer rights protection Charlie has received numerous awards for his work in support of disabled vets and public health care.

But the thing we'll remember best about C Charlie is that he was always able to find time to lend a hand to his fellow ham; his encouragement helped many of us with out ham radio projects and problems. W4KFC.

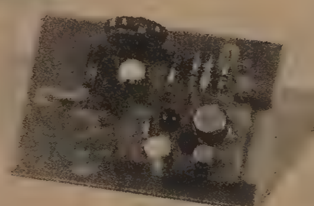
SSTV CONTEST RESULTS indicate that Rolland N6WQ was first overall, and tied John WB9OGS in the most states/provinces catagpry. Awards and prize subscriptions were awarded by ATV Magazine because the contest sponsors were unable to. Suggestions for improvements in next years contest should be sent to Brooks W1JKF or Henry KB9FO. 73

NEW SSTV CONTEST

Don W9NTP offers the following. In order to encourage furthur investigation into the fascinating field of SSTV and associated subjects, A% has agreed to help sponsor a competition for the development and modification of scan converters and other video related gear. The SSTV net has existed for many years on 14,230 Khz at 1800 GMT each saturday. In the first hour of the net (1800-1900GMT) the operation will be split into two general modes. The fist part for checking out equipment, the second hour devoted to improvement of equipment and advancing the state of the art. There are many mods that can be made to the Robot 400 and other digital scan converters. A5 and the Dayton SSTV Forum would like to honor the best modifications to a Robot 400 by awarding a plaque and life subscription to A5 to the developer. There may be other catagories of competition as well. It should be understood that any modification to your Robot 400 will void the warranty. As ARRL central divison director, Don w would like to go on record to say that he feels that technical development by hams can go farther in the growth of our hobby. The technical part of the SSTV net will be dominated by technical types that are improving the state of the art. Robert Suding and and Don Miller (WØLMD, W9NTP) will serve as net control for that portion of the net. There will be discussion and encouragement of questions about all phases of computer interface and modifications of the Robot 400 which many of you own. Many investigations require the availability of an additional meory board. W9NTP will supply at cost, memory boards to any investigator. If you are lacking ideas There is alist of a few later. A5 will publish all modifications and achievements immediately so everyone will know what is going on. Let's prove that hams are not just appliance operators but lead the way for others to follow. 73 Don W9NTP

P. C. ELECTRONICS

BUILD OR BUY!
UR SUPERMARKET
FOR ATV



VIDEO MODULATORS

VM-1 TUBE TYPE ATV MODULATOR . . . . $15.00 ppd
for tetrode 5894, 6907, 6524 tubes. ie, CMU15.

VM-2 HIGH POWER TUBE MODULATOR . . $19.50 ppd
for 4X250 tubes such as in K2RIW amp (apr 72 QST).

VM-3 TRANSISTOR ATV MODULATOR . . $19.50 ppd
for 1 watt xmtrs such as VHF ENG. TX432B exciter.

All modulator pc boards only . . . $3.50 ppd

U SAW IT ON THE AIR AT DAYTON

***COLOR CAMERA HITACHI GP-5 . . . . . . $1295.00 ppd**
Semi professional quality 3 electrode stripped vidicon for superior color reproduction. Built-in 1½" monitor, speaker, and microphone. 6:1 ZOOM lens. Can be run on external 12vdc @ only 900ma for portable or mobile work. Variable color temperature control. Small and light . . . 4.8 lbs.

NEW

TVC-12 1200 MHZ ATV CONVERTER . . . . $79.00 ppd
Tunes 1215 to 1300 mHz from the shack. Can be mounted at antenna to save line loss. Outputs on channel 7 or 8. Req. 12vdc reg @ 20 ma and 10K pot. High rejection to 439 when used with SI loop yagi for full duplex ATV. LOOP YAGI 58.35 + SHIPPING

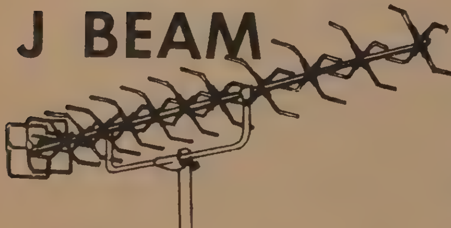
ATV ACCESSORIES

RF/VIDEO DETECTOR & MONITOR . . . DM-1
Connects to antenna coax to sample the xmtr RF. Receiving your own RF can be misleading. This module detects the actual modulation and drives a monitor. Also gives relative power. 10 to 18 VDC @ 25ma.
PC Board . . . $4.00 Complete, tested . . . $17.50

ATV TEST GENERATOR . . . TVG-1
Connect your camera and you have about a 1 mw transmitter on the air to check out your receiver, antenna, give demos, etc. Just a simple modulated oscillator set between 420 and 450 mHz.
Requires 9 VDC @ 5 ma.
Complete, tested . . . $12.00 ppd

VIDEO CALL IDENTIFIER . . . VID-2
SUPERIMPOSES YOUR CALL of any 6 alphanumeric combination over your camera video. A must for repeaters. Connects in coax line between camera and transmitter. Has internal sync separator, so no digging into the camera for vert and horiz drive. Controls for position, in/out, black/white, and 2 camera video switcher. Requires 12 VDC @ 200 ma.
Extra programmed ROM . . . $12.00, allow 5 weeks aro for programming, built and tested with one call. . $99.00
VC-1 VIDEO CLOCK-6 digit 12/24 hr. . . . add $49.00

J BEAM



MBM48/70cm ANTENNA

ONE OF THE FEW ANTENNAS THAT HAS ENOUGH BANDWIDTH FOR ATV..3DB DOWN AT 420 and 450
*15 DB GAIN OVER A DIPOLE
*6 FOOT BOOM LENGTH
*50 OHM FEED
*26 DEGREE BEAMWIDTH

ONLY $56.30 plus shipping

LINEAR AMP

NEW!

EDT 432P LINEAR AMP GIVES 60 WATTS OUT FOR 10 WATTS IN..BUILTIN POWER SUPPLY, FAN, T/R ANT RELAYS, AND METERING..READY TO GO..$330 + SHIP. 22 LBS FREIGHT. 11x7x11.

*ANTENNAS & 60 WATT AMP COD OR CHARGE CARD ONLY

All prices are delivered in USA. All orders are check, money order, Master Charge, or Bankamericard. Allow 3 weeks after receipt of order for delivery. Charge card orders only by phone 5 to 6 PM your time: (213) 447-4565.

 TOM W6ORG P.C. ELECTRONICS, 2522 PAXSON LANE, ARCADIA, CA 91006

P.C. ELECTRONICS

MAY 79 CATALOG OF PC BOARDS AND MODULES FOR YOUR COMMUNICATIONS SYSTEM

Solid State Fast Scan ATV Modules

COMPACT
10¾x7x3¼

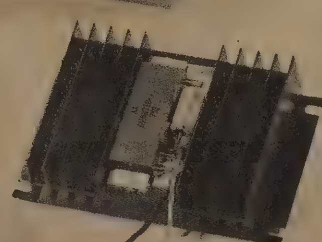
ATV TRANSMITTER/CONVERTER—TC-1 $399.00 ppd
All you need in one box. Contains the TXA5-2, PA5, TVC-1b, FMA5 modules described below in an attractive cabinet with regulated power supply and solid state T/R relay. Specify 434.0 or 439.25 mHz transmit and TV receiver channel 2 or 3. Connect to antenna terminals of any set, add a good 450 antenna, camera or computer and you are ready to show the shack, home moves, computer games, etc. 12-14 VDC and AC version add $30. On carrier audio . . . add $50. SOUND SUBCARRIER STD.

HITACHI HV-62 TV CAMERA . . . . $239.00 ppd
High performance CCTV camera perfect for ATV applications. Resolution better than 500 lines. Low power consumption on 117 vac line . . . 7 watts and can be modified to run on 12 VDC for mobile and portable work. Small 4x2-5/8x8 inches. C mount lens included. 10,000:1 automatic light compensation. Built in gamma correction for high contrast. 12 to 18 VDC @ 230 ma and interlaced sync version . . . add $50.

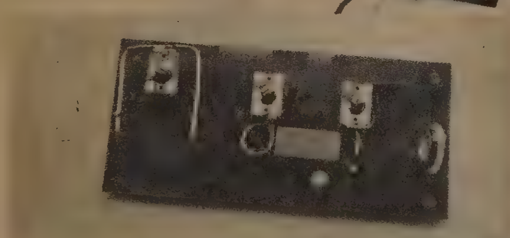
ON BOARD
MODULATOR

TXA5-2 ATV EXCITER . . . . $69.00 ppd
This is a wired and tested module designed to drive a Motorola MHW-710 power module to 10 watts output. (The MHW-710 is part of the PA5 module below.) The TXA5-2 consists of a crystal oscillator operating in the 100 mHz region to keep any harmonics out of two meters, two doublers and a final. The high resolution video modulator (8 mHz) drives both the final and 2nd doubler for good linearity. Also DC restoration is used to give max power on sync tips and black blacks regardless of picture average level. Requires +12 VDC reg @ 70 ma, and crystal. (International type 473160 f/4) Tuned with xtal on 434,439.25, or 427.25 . . . add $15. CA-1 on carrier audio/18mHz osc module add $39.

FULL 10 WATT
RMS POWER
ON SYNC TIPS



PA5 10 WATT ATV POWER MODULE . . . . $79.00 ppd
The PA5 will put out 10 watts of high resolution video when driven by the TXA5-2 Exciter or VHF ENG. TX-432B (attenuated down to 80mw). TXA5 modulation matches the PA5 gain curve to give good linearity for color reproduction.
Requires 12 to 14 vdc reg @ 3.0 amps and 80 mw drive.



*IMPROVED
PREAMP

TVC-1B ATV RECEIVING CONVERTER . . $49.50 ppd
Very sensitive MRF901 (1.7 db nf) preamp and double balanced mixer module digs out the weak ones but resists intermods and overload. Connects between antenna and TV set tuned to channel 2 or 3. Varicap tuning (420 to 450) allows remoting at antenna to save coax loss. Requires 10 to 18 vdc @ 20 ma. Super sensitive TVC-1C with NE64535 (.9 db nf) preamp . . . $79.50 ppd

FMA5 AUDIO SUBCARRIER GENERATOR . $24.50 ppd
$4.00 Board
Put audio on with your camera video. Connect your low Z (200 ohms) dynamic mic, >10 VDC @ 25 ma, TXA5-2 or any of the VM-1,2,3 modulators and you are set to show and tell. The FMA5 has lots of mic gain and a soft limiter for pick up to 25 feet. It modulates a 4.5 mHz VCO to the full TV standard deviation of 25 kHz. Works with any transmitter having 5 mHz video bandwidth modulation. NOW WITH ON BOARD 8V REGULATOR!

1. Load only a part of the screen with a modification of a picture already loaded into memory. The screen can be divided into 4 parts with your picture in a different pose in all four corners.
2. Add another memory for 256 resolution in either the horizontal or vertical direction.
3. Add color to the Robot 400 (improve the W9NTP version).
4. Adapt the Robot 400 to load a microprocessor for frame grab. The present microprocessor systems cannot load a fast scan picture directly into the computer memory without stopping all computation.
5. Transmit SSTV digitally. It may take 4 times as long but the pictures may be better. What is the fastest that you can send SSTV ones and zeros?
6. Provide an automatic video gain control for the Robot 400. This will make it possible to better match the camera to the A/D converter without contouring.
7. Add pixelaveraging, line averaging, or field averaging. It is not easy to do on the Robot 400 because of gray coding of the A/D conversion.
8. Design an electronic pencil so that handwriting can be directly written on the screen.
9. Add "teletext' capability. Write high resolution lettering on the picture. This can be easily done with 40 characters to the line.
10. Modify the Robot 400 to some form of MSTV for faster transmission.
11. Modify the Robot 400 for high resolution slowed down transmission.
12. Add a flag capability to point out objects in your picture.
13. Synchronize incoming SSTV with your locally generated SSTV for overlay etc.
14. Design a special effects generator especially adapted for SSTV.
15. Modify the output of the Robot 400 so that the fast scan output can be video tape recorded on Sony type video tape recorders. The system as it now stands is not compatable with RS 170 interface.
16. Modify the output of the Robot 400 for a serial digital output for telephone lines and other serial data streams such as computer loading and other data transmission systems.

I hope that these ideas will start your old amateur radio ingenuity going so that you will be inspired to talk about your technical ideas on the air. Let us improve our "IMAGE" by using our equipment for something other than the repeat of someone else's pictures and the transmission of girly pictures.

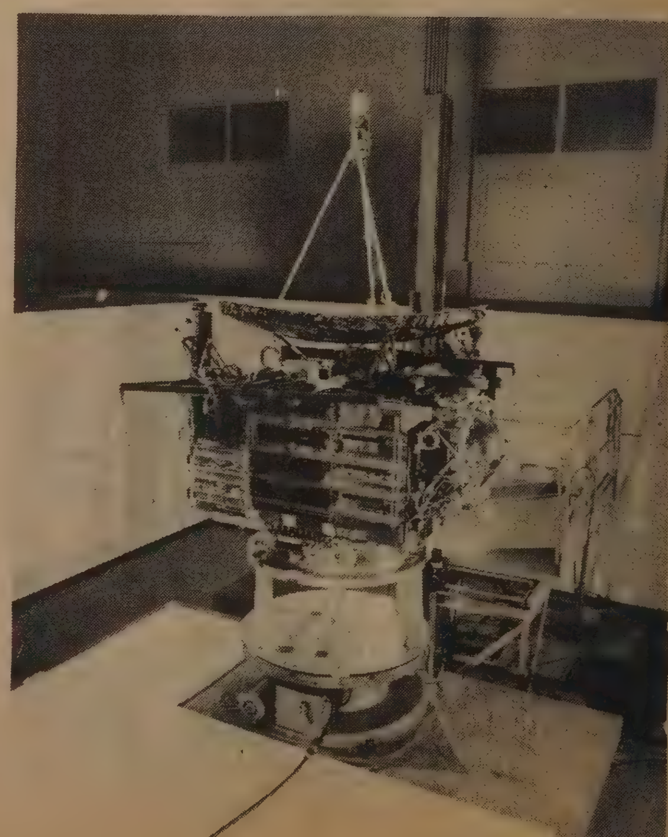
Good Luck

73 Don, W9NTP

WHERE IT ALL STARTED

The first use of an orbiting satellite to relay television pictures occured in 1962 with an early satellite known as Telestar. This satellite, like many of those launched during the 60's, went around (and around) the earth in a prescribed pattern or orbit. To transmit signals to and receive signals from these early satellites required that the earth-bound terminals be capable of 'moving' with the satellite, following it across the sky as it appeared first over one horizon and then moved onto the opposite horizon.

In 1963 an experimental satellite developed by Hughes called Syncom was placed into a different type of orbit; one called 'Geo-stationary' (or synchronous). In this type of special orbit the satellite is placed directly over the equator, some 22,300 miles above the earth. The forward speed of the satellite is matched precisely to the rotation speed of the earth on its axis. In this way as the sa-



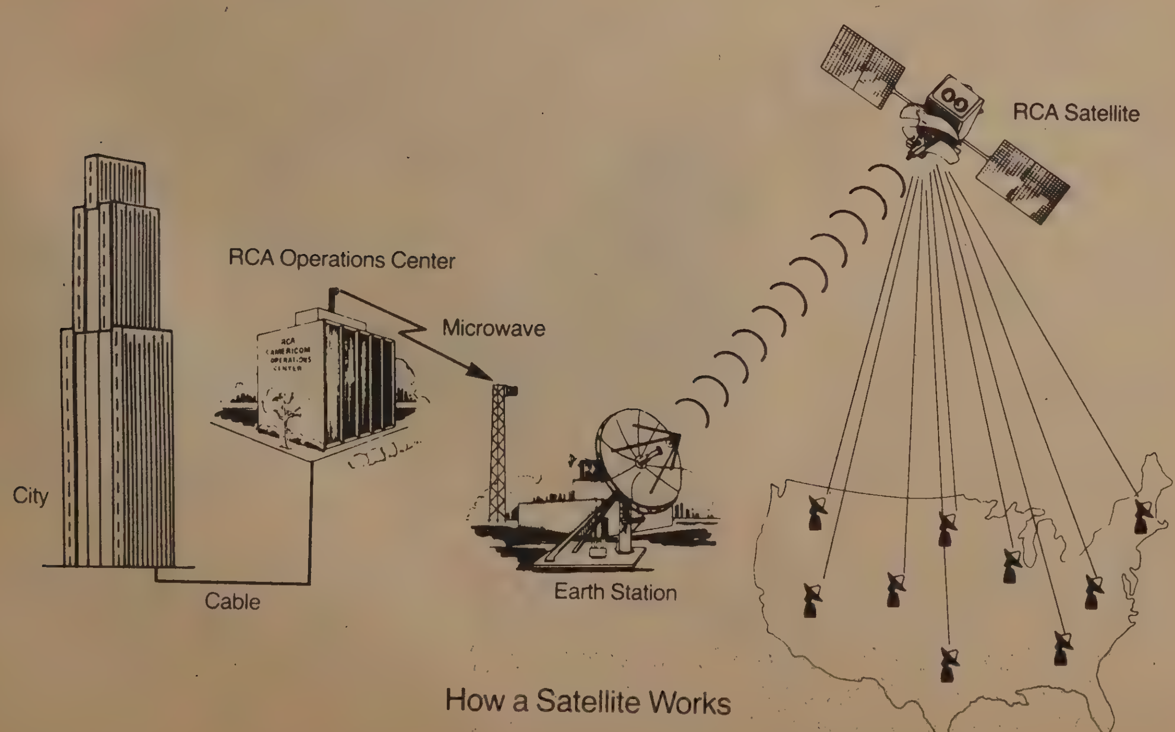
tellite makes its circular orbit around the earth the earth is revolving on its own axis below the satellite.

To an observer on earth, on the ground, the position of the satellite in the sky remains stationary; it has the illusion of 'standing still'. This principle, first set forth way back in 1945 by space visionary Arthur C. Clarke, is the basis for todays generation of highly complex space satellites.

The satellite, such as the General Electric developed Japanese BSE system shown on the preceding page, is launched into orbit aboard a rocket. Because of the special orbit requirements geo-stationary satellites are launched from two principal locations in the world. Cape Kennedy, Florida is the primary such launch point for the free world. The satellite launch manuever involves lifting the satellite off the ground (typically aboard a Thor-Delta class rocket) in an easterly direction. A relatively low orbit is attained while the satellite and rocketry is checked out. Then the satellite is 'boosted' into a transfer orbit which moves it higher above the plane of the earth and into a much higher 'equatorial plane' orbit; directly above the equator, and pointed in an easterly direction (as seen from earth).

Once the satellite reaches its intending 'parking spot' (nations of the world have convened to allocate places over the equator to one another) its forward motion is stopped; relative to the speed of the earth's own rotation. At this point it is 'stabilized' and minor location adjustments made with on board miniature control rocketry.

The satellite receives its power from the sun, through (electronic) solar cells,



How a Satellite Works

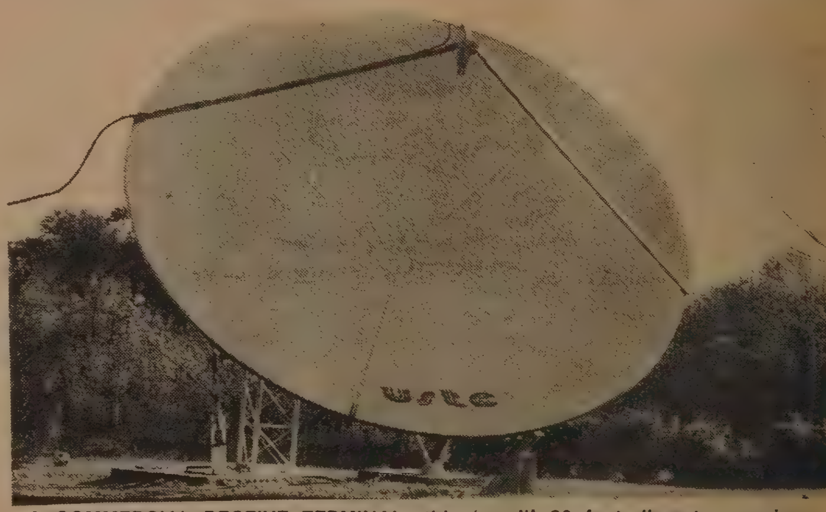
Power is stored in special (Nicad) batteries.

The satellite is essentially a (microwave frequency range) relay station; not unlike the telephone company microwave stations one sees all across America. Only this 'relay station' cannot be fixed with service calls, cannot be connected to conventional power sources, and must fix itself when something goes wrong. The communications satellite is truly an incredible creation of mankind.

As a relay station, special 'uplink' stations situated on earth send signals to the spacecraft. The signals are transmitted up (as in 'uplink') on one frequency band, and after being received by the satellite receive system they are converted to a new 'downlink' frequency band. On earth a receiving station tuned to the downlink frequency band receives the signals relayed through the satellite. In most situations the time required for the signal to travel the approximately 45,000 miles is 1/5th of a second.

AN UPLINK TERMINAL—this 'small' 36 foot diameter antenna plus the transmission equipment housed in the portable building makes up the package required to send television signals to the satellite on the upward-bound direction.

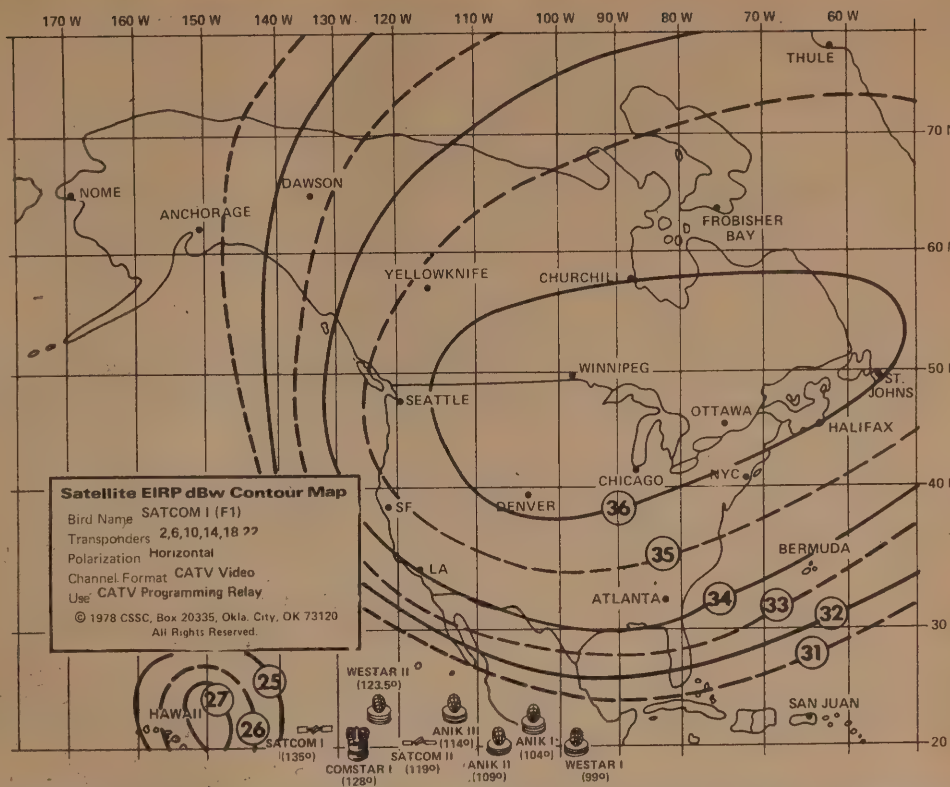
Because of its high altitude vantage point (22,300 miles above the equator) the satellite has a 'direct line-of-sight' transmission path to a large portion of the earth's surface. This direct path, from the satellite to your location, is the secret of the satellite quality of reception. From most earth bound vantage points the satellite is 'up' (and from the northern hemisphere 'south'). This means your receiving dish antenna points up towards the satellite; away from trees, buildings, and the earth itself (all of which create interference to normal earth-bound TV transmission/reception systems).



A COMMERCIAL RECEIVE TERMINAL—this 'small' 20 foot diameter receive antenna is typical of those found at hundreds of U.S. cable TV (CATV) systems around the United States. This antenna, in use by CATJ editor-in-chief Bob Cooper, is more than three times the size of the really 'small' 6 foot antenna on the front cover of this pamphlet.

And because the signal travels over a 'direct' or line-of-sight path from the satellite to your receiving antenna, there is virtually no fading nor signal changes from day to day or season to season. It is a remarkably stable, interference free form of communications; far superior to all other previously employed forms of television (and radio) communications. To limit the 'service area' of the 22,300 mile high satellite specially designed transmission antennas are employed on the satellite. These antennas create 'signal patterns' on the earth below; patterns called 'foot-

prints'. The footprint pattern is important to anyone designing a satellite receiving terminal since it tells the system designer how much signal to anticipate from the satellite at that location. This in turn tells the receiving system designer what size (i.e. sensitivity) receiving antenna he needs, and other receive system parameters for that location.



THIS SPECIAL MAP—indicates the 'signal strength level' from the RCA SATCOM F1 satellite (on the transponder/channels listed on the map) over all of North America. A full set of maps, covering all satellites and transponders/channels is available from the source listed pages 51-52.

Different satellites have different footprints. And with the RCA satellites different channels or transponders (as the channels are known) have different footprints.

To design or specify equipment for a receive terminal at a specific location (or region within North America) requires a small bit of advance planning, based upon some accurate data from the satellite operators. The alternative to this is to simply design the receive terminal for maximum sensitivity practical within the constraints of the budget available, and accept slightly varying quality of reception from satellite to satellite or within the single satellite in the case of RCA (SATCOM) 'birds'.

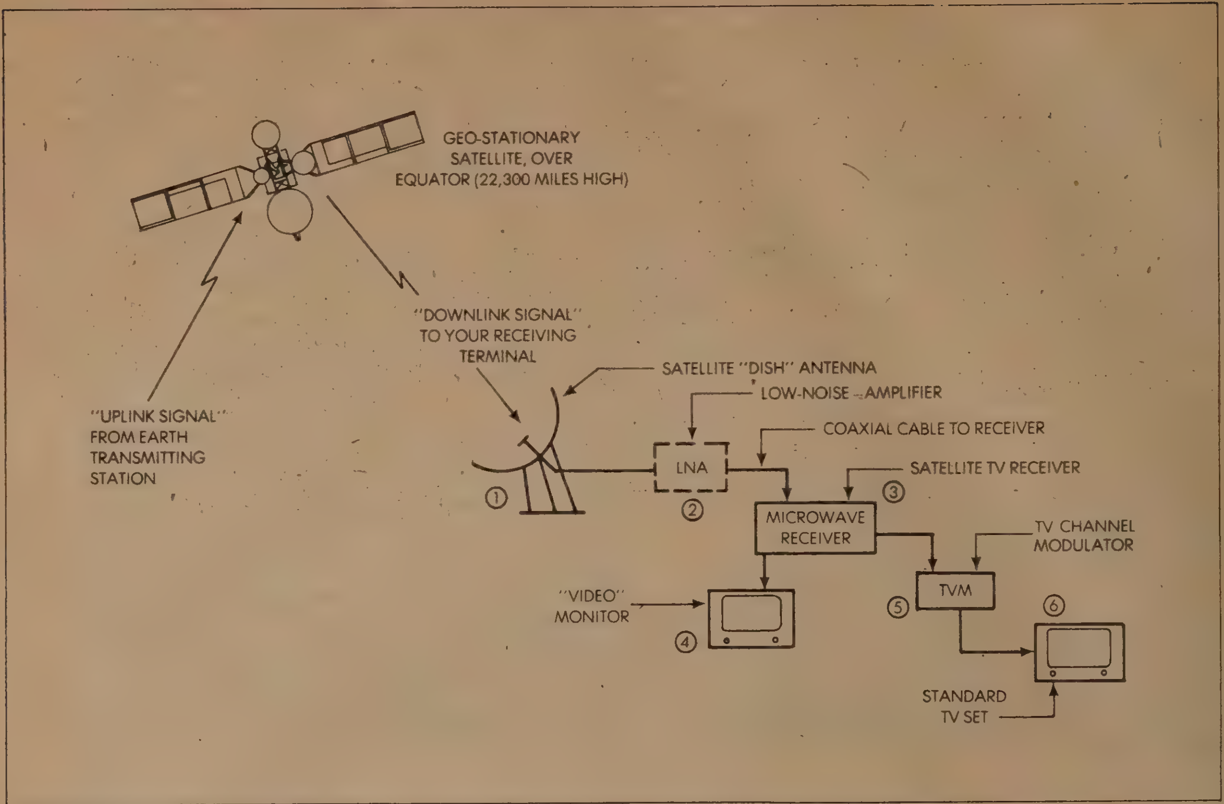
THE RECEIVE TERMINAL

The receive terminal (Home Satellite Terminal, or HST) consists of the following basic parts:

1) The receive antenna - typically a shallow metal (or fiberglass impregnated with metallic particles) 'dish', equipped with a mechanical system to mount it on the ground and often equipped with some system to allow the 'dish' antenna to be turned (or rotated) from satellite to satellite.

   There is one basic rule with 'dish' antennas to remember. The bigger their diameter (or aperture as it is sometimes called) the higher (or greater) their gain. The greater the 'gain', the more sensitive they become. Which is another way of saying bigger antennas will receive weaker signals better than smaller antennas.

2) The Low Noise Amplifier (LNA) - this is akin to the 'antenna mounting TV signal booster' which folks who lived in TV fringe areas used to employ in the 50's



THE BASIC RECEIVE TERMINAL—consists of 'boxes plugged together'. Signal coming to you from the satellite is called 'downlink signals'.

and 60's to improve regular TV reception from distant ('fringe') stations. Only this 'antenna mounting signal booster' is a piece of space-age electronics with a price to match. So low in signal level is the satellite signal as received by the receive antenna that the LNA must be placed directly at the point on the antenna where the signal is first picked up. Even a few feet of cable connecting the antenna to the LNA could kill the small amount of signal present.

Between the LNA and the receiver (see diagram on page 8) is a another special 'part'; very low-loss coaxial cable which because of its unique characteristics sells in the $2.50 per foot region! On top of this, this (7/8th's inch diameter) cable should be kept as short as possible, typically under 200 feet, if sufficent (amplified) signal is to reach the receiver itself.

3) The satellite receiver - is basically a 'microwave television receiver'. This is not something you will find on display at your local appliance store, nor in the neighborhood Radio Shack. These special receivers are produced by a handful of (U.S.) companies in relatively small production quanities (sources will be given later in this phamplet).

Unlike your home television receiver, this one does not have a 'screen' or a speaker. It is intended to be connected to a separate box known in the trade as a 'video monitor', to display the picture and sound to you. A video monitor is essentially a TV set without a 'tuner' (or channel selector), which is another way of noting that the satellite receiver is essentially a TV receiver operating in a special (microwave) frequency band ... without a picture tube and speaker.

To 'see satellite TV pictures' (and hear the accompanying sound) you must connect the satellite receiver to either a 'video monitor' (with a built in speaker for the 'sound line'), or to a ...

5) TV modulator - which is essentially a (very) low power 'TV transmitter'. The TV modulator converts the video and sound coming from a satellite TV receiver to a signal which your normal home TV can pickup.

6) The TV receiver - in your home then becomes the final link in the system. It is connected to the TV modulator and as a matter of fact dozens and indeed hundreds of separate TV receivers can be connected to a single modulator through appropriate (coaxial) cable without any need for additional electronic equipment.

If this sounds like a great deal of equipment, lots of connections and many complications ....fear not. The total skills required should not frighten away anyone with average intelligence and the ability to utilize normal hand tools.

WHAT CAN YOU RECEIVE?

All of the equipment in the world is not good for much except display unless there is something 'out there' to receive. It turns out there is a great deal to receive, and more becomes available every month.

All of the satellites we will discuss here operate in the same frequency band. Many of the services we will describe or list operate on the same satellite frequency. A logical question would be "What insures that the signal from one satellite does not interfere with the signal from another satellite, at your receiver, if they all operate on the same frequency band and often the same channels?"

CHANNEL 9 NEW YORK CITY—is one of four 'independent' (i.e. non-network affiliated) stations either now carried by satellite or scheduled for an early start. Picture via WESTAR II satellite as received in Oklahoma.

The antenna is the answer. Even though the international agreements assign satellites to locations above the equator in 4 to 5 degree steps (i.e. RCA SATCOM F2 is located at 119 degrees west while Western Union WESTAR II is located at 123.5 degrees west), from your receiving point on earth your receiving antenna will be capable of 'seeing' one and not the other. Which is another way of saying that if you can move (or 'rotate') your receiving antenna left and right (i.e. east and west) while maintaining the proper 'elevation' angle (i.e. the direction 'up' it points) you can switch satellites with relative ease.

Each satellite has multiple channels operating. In the case of television, this varies from a low of 3 television channels on a specific satellite to a high of 12-15 television channels for a single satellite. In other words, having chosen the antenna 'heading' or satellite desired, you then tune your receiver through the frequency band in operation and pick out anyone signal or transmission you wish from the

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